Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XXXVII. No. 4. NEW YORK, WEDNESDAY, JULY 25, 1900. ISSUED WEEKLY.

Electrical Review

TIMES BUILDING, 41 PARK ROW,
P. O. BOX 2330. NEW YORK.

CHARLES W. PRICE, - - - - - - - - EDITOR.
STEPHEN L. COLES, - - - - MANAGING EDITOR.
CHARLES T. CHILD, - - - TECHNICAL EDITOR.
STEPHEN H. GODDARD, - - ADVERTISING MANAGER.
RUSSELL HOWLAND, ASS'T ADVERTISING MANAGER.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," - - - - NEW YORK.

TELEPHONE CALL, 1546 "CORTLANDT."

WESTERN OFFICE:
FRANK E. COLBERT, - REPRESENTATIVE.
1612-1613 Marquette Building, Chicago.

WASHINGTON OFFICE:
GEO. C. MAYNARD, - - REPRESENTATIVE.
Room 102 Washington Loan and Trust Building, WASHINGTON, D. C.

LONDON OFFICE:
HENRY W. HALL, - - REPRESENTATIVE.
42 Old Broad Street, LONDON. E. C.
News, Subscriptions and Advertisements

Subscription to the ELECTRICAL REVIEW.

One Year, United States and Canada, - - - $3.00
One Year, Foreign Countries, - - - - - - - 5.00
Single Copies, each - - - - - - - - - - - .10
Copies can be supplied for only one year back, at 25 cents each.

CONTENTS:

	PAGE
Where Electric Traction Is Badly Needed	74
The High-Speed, Three-Phase Railway from Toledo to Norwalk, Ohio	75
Death of Winthrop Thayer	79
Personal	79
An Unusual Railway Accident	79
Praise from Sir Hubert	79
Science Brevities	80
A Theory of the Coherer	81
Tests of Automatic Street Railway Brakes	81
Visit of the American Institute of Electrical Engineers to London	81
Arc Lamp Distribution	82
Some Modern Types of Current Generators	84
American Engineers in England	85
Electric Railways	86
Telephone and Telegraph	87
Exhibition by the Automobile Club of America	88
Roentgen Society of the United States	88
Hewitt-Lindstrom Electromobiles	88
Automobile Notes	88
The Paris Exposition Exhibit of the Standard Paint Company	89
Literature	89
Personal	89
Third Rail System in Brooklyn, N. Y.	89
Views, News and Interviews	90
Electrical Progress in Australia	90
Wall Street and the Electrical Stock Market	90
Another Murderer Electrocuted at Sing Sing	90
A Consolidation of Two Western Electrical Houses	91
New German Process of Welding Pipes	91
Automatic Electric Arc Lamp Support	91
Storage Batteries in a Print Cloth Mill	92
Book Reviews	93
Obituary	93
Corporation News	94
A New Ignition Battery	94
Electric Lighting	95
Electric Car Lighting	95
Industrial Notes	96
Electrical Patents	27

Advertisers' Index, page 12

It seems strange that in all the building of electric railways which is now going on in the United States not one single polyphase system has been installed. We have numerous and increasing examples of combination systems in which polyphase currents are generated at a central point and transmitted at high tension to sub-stations and there redistributed as direct current to the line. If it were possible to construct motors and car equipments using a polyphase source of supply directly, all of the expense and complexity of the sub-station could be avoided and a highly efficient and highly satisfactory variety of distribution secured that would make easy the somewhat difficult problem of long-distance electric railroading. All of the European experiments that have been made in this direction have met with a flattering degree of success and it seems time certainly that American engineers should take up the question of the direct application of this variety of current to car motors. It seems as if the time is ripe, for the simplicity, mechanical strength, high efficiency and other desirable qualities of the induction motor lend themselves with peculiar readiness to electric railroad work. It is probable that there are difficulties connected with the starting of such motors under load, but these difficulties are by no means insuperable, nor do they entail any great complexity of apparatus or design. The question is one that is certainly worthy of the attention of all interested in the advance of the electric arts, and especially of those railroad managers who are following the natural tendency of progress in this country and amalgamating together various short lines of trolley road into long systems.

We hear very little to-day about the Nernst lamp. The hopes that were raised to a high point by the announcement of Dr. Nernst's interesting invention have seemingly withered, and, outside of the Paris Exposition, there does not seem to be a single installation of the new lamps in existence. There can be no doubt that the direction indicated by the German inventor is one that would be profitable to follow. An increase in the efficiency of translating devices for electric lighting would produce a highly desirable condition of affairs and greatly aid in the extension of such lighting in places where it is now considered too expensive. The fact that those of us interested in electrical matters know that electric light is not expensive as compared with gas or other illuminants is of little importance, so long as the majority of the public are firmly convinced that an electric light is a luxury. As a matter of fact, in cities, it is a necessity, and as such is recognized by the more intelligent portion of the people. Still, any revolutionary invention that would tend to cheapen electric light service would make this variety of light more popular and would go further toward driving the gas companies into their proper position—that of supplying a convenient source of small power and heat.

The Automobile Club of America appears to be alive to the opportunities it has for bettering both the sport and the business of automobilists. It has advertised for information regarding places where storage batteries for electromobiles may be recharged so that it can present this information in its forthcoming book for the benefit of its members. Such a publication as this has been urgently needed and doubtless will be highly appreciated. There must be many places, especially in the vicinity of greater New York, where an electromobile can have its batteries filled. It is of profit and mutual interest both to the proprietors of such charging stations and automobilists in general to have their situation made public, and it is urgently hoped that the club may succeed in the laudable task it has undertaken.

WHERE ELECTRIC TRACTION IS BADLY NEEDED.

At a point near the centre of Manhattan Island stands the large passenger station of the New York Central & Hudson River and New York, New Haven & Hartford Railroads, and from it running north is a four-track structure extending beyond the Harlem River. For a few hundred yards these tracks are on the surface, but at a point about one-half mile north of the station they enter a tunnel, or rather, three tunnels, there being one central and two side tunnels, and in these the tracks continue north for about three miles, emerging upon a steel viaduct which traverses the upper end of the island and crosses the Harlem River. This stretch of terminal track is one of the busiest in the world and trains pass along it at intervals of only a few minutes during the day and night, and with almost the frequency of trains on the elevated railway during the rush hours of suburban travel in the morning and evening. Despite attempts at ventilation, in certain parts of it the tunnel is almost always full of noxious and heated gases from the many locomotives that traverse it and passengers passing through it at this season of the year in cars in which every window and ventilator is tightly closed come close to suffering asphyxiation. It is probable that if an accident delayed one of these trains a half-hour or more some of its passengers would miserably perish. So great is the popular horror of this tunnel ride that more than any other thing it has retarded the development of the beautiful suburban region lying along the north shore of Long Island Sound and practically accessible only by this route.

In former days the tunnel system was operated to Thirty-fourth street, several blocks south of the present Grand Central Station. When the new station was built at Forty-second street, the section of the tunnel south of that point was turned over to the street car companies. In the days of horse cars the tunnel was not particularly pleasant, although it had been whitewashed inside and in warm weather was cool, but, naturally, the presence in it of horses made its atmosphere as disagreeable, though not as dangerous, as that of the gas-laden tunnels further north. To-day it is traversed by electric cars of the Madison avenue line, which are permitted to run at high speed through the tunnel, and, on a warm day, the tunnel section is the most agreeable portion of a journey on an open car over this line. It is clean, well lighted and naturally always cool. All of this has been accomplished for it by the introduction of electric traction.

With this object lesson before them the railroad managements handling the heavy passenger traffic in and out of the Grand Central Station have hardly a legitimate excuse for retaining the annoying steam locomotives in their tunnels. It is probable that the conservatism which marks American railway managements and makes them cautious (almost always with wisdom) in adopting improvements which are outside of their experience is all that is preventing the electrification of these tunnels. Coupled with this is a natural objection to the delay of about two minutes involved in the exchange of the steam for the electric locomotive at the northern end of the viaduct. It can hardly be doubted that the traveling public would gladly put up with a delay several times longer than this to secure freedom from the discomfort of the underground passage under Park avenue. From the engineering point of view, the problem of constructing, operating and maintaining the necessary conducting system and locomotives is absolutely easy and one to which experience gained in several installations can be brought. Its success is perfectly certain from the beginning and its cost need not be very large. It is probable that the whole plant, including five miles of quadruple track construction, 10 electric locomotives and a power house, could be erected for less than $800,000, this figure including the lighting and beautification of the tunnel. The expenses of operating the electrical section would not differ greatly from those now met in working the section by steam locomotives. Interest at five per cent on the sum mentioned is $40,000 annually. Can any reasonable person doubt that the increased travel to the suburban regions reached by the lines terminating in the Grand Central Station would very soon far over-balance this expenditure? The New York Central & Hudson River Railroad has already expended millions of dollars in extensions and improvements of its terminal service in New York. Among the important works it has recently carried out are the construction of a magnificent viaduct in the north end of Manhattan Island and a bridge across the Harlem River, extensive improvements and extensions at the Grand Central Station, the abolition of grade crossings in the city and numerous less extensive betterments. We feel that the same able and far-seeing management will not long neglect the opportunity now offered for the final perfection of its service.

It is evident that every consideration of expediency, and the promptings of that progressive spirit which should animate the management of any corporate interest, point to the electrical equipment of these tunnels. As they stand now they are not only exceedingly uncomfortable and a menace to the health of those compelled to travel through them, but they are an absolute anachronism which should not, to-day, exist in the metropolis of the Western world.

The most remarkable feature about the electrical trades this Summer is their amazing activity. There has not been, up to now, any of the falling off in volume of business that is usual at this time of year. Ordinarily it is hard to make a citizen whose mind is fixed on recreation, and who is thinking of the trout leaping in the pools or the white caps flashing in the cool ocean breeze, sit down in his city office (even if he has a fan motor) and talk business. The details of business and the affairs of everyday grow far off and of little importance to the man with vacation in his fancy. But this year nobody has been able to get away; nobody has even gotten so far as to think much about holidays; everybody has been at work. But they are not unhappy, for it now looks as if 1900 would be a record year in the electrical business, and as if all the manufacturers and dealers and contractors would have the wherewithal to spend long vacations next Summer—if they have time to go.

The High-Speed Three-Phase Railway from Toledo to Norwalk, Ohio.

The new railway in Ohio, from Toledo to Norwalk, is the latest example of the long-distance electric railways which have been made commercially possible by the application of alternating current. The entire length of the railway, 60 miles, is supplied with current from a central power house at Fremont, a high voltage being used to transmit power 30 miles in either direction to six substations, where it is lowered and converted to direct current for feeding the trolleys.

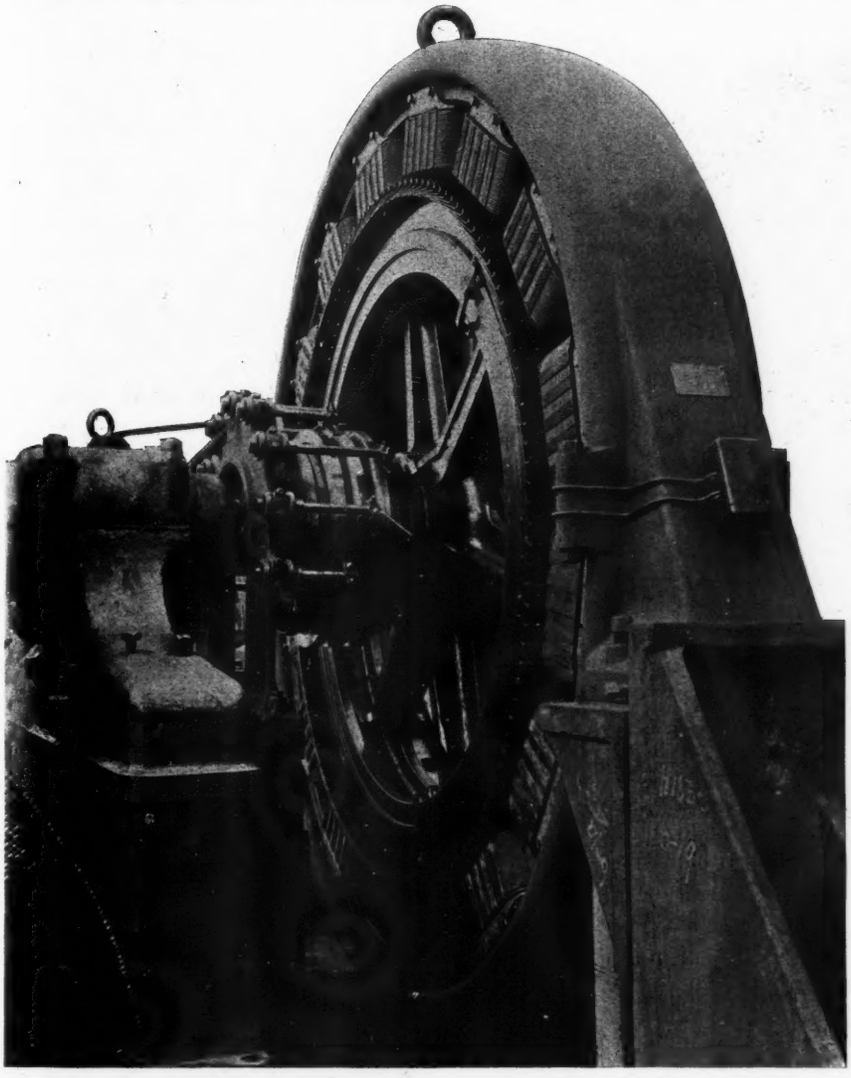


FIG. 1.—500-KILOWATT THREE-PHASE GENERATOR FOR TOLEDO, FREMONT & NORWALK HIGH-SPEED ELECTRIC RAILWAY.

Since alternating current has been adapted to the use of electric railways, interurban roads from 50 to 100 miles in length are being rapidly exploited in the Central States, where the surface of the country is fairly level and comparatively little expense is incurred in grading and bridging.

The electrical equipment of this railway follows somewhat the lines of the Rapid Railway, of Detroit, both of which were designed and equipped by Westinghouse, Church, Kerr & Company. The cars will run over the tracks of the Toledo Traction Company to the city limits, a distance of three and one-half miles. From this point they pass over their own tracks, *via* the Woodville Turnpike, and proceed in a straight line for about 10 miles; then on a private right-of-way for two miles through a well-populated oil district, bringing them upon the Western Reserve and Maumee Turnpike, which is followed in a straight line for 31 miles. This turnpike is the oldest road in northern Ohio, having been ceded by the Indians over 150 years ago. The towns and cities on the line are Toledo, with 180,000 population; Genoa, 800; Woodville, 1,200; Hessville, 500; Fremont, 10,000; Clyde, 4,000; Bellevue, 6,000; Monroeville, 4,000, and Norwalk, with 12,000 people. The adjacent country is rich and fertile, producing large quantities of agricultural supplies. The railway will make special efforts to develop the freight traffic, as there will be large quantities of fruit and dairy produce to be carried into the cities. The track crosses the Lake Shore, the Wheeling & Lake Erie, the Baltimore & Ohio, the Lake Erie & Western, the Big Four, the Pennsylvania and the Nickel Plate, with all of which junctions can be made, and railway cars hauled over the tracks of the Toledo, Fremont & Norwalk Railway.

The surface of the country through which the railway passes is mainly level, the steepest grade being three per cent, and that but for a short distance. There are 24 bridges; one over the Portage River at Woodville, has two steel truss spans, each of 180 feet, and another, over the Sandusky, at Fremont, has four spans, each of about 160 feet.

Extensions of the line are under consideration, one of them to continue the line from Norwalk to Oberlin, a distance of 20 miles, and the other to form a branch from Tiffin to Port Clinton on Lake Erie, to serve Put-in-Bay.

The central power house at Fremont is situated upon the east bank of the Sandusky River from which the water is obtained for feeding the boilers and for condensing purposes. A considerable tract of land, situated less than half a mile from the centre of the city of Fremont, and adjoining Main street, has been secured by the company, and upon it is being erected a good, substantial power house, car house and car shop. The power house is of fireproof construction throughout, made of brick and iron, with concrete foundations. The roof is formed of tile and cement arches. The engine room is lofty, to accommodate vertical engines, and large, arched windows admit an abundance of light. There is a high, well lighted basement under the engine room. Water for the boilers, and for the condensers will be pumped from the Sandusky River, through one six-inch and two 14-inch pipes. In the rock bed of the river a channel has been cut to insure a constant supply of water to the intake well. Two Worthington compound circulating pumps, having cylinders 9 inches by 14 inches and 19 inches by 15 inches stroke of piston, each have their suctions in this well, and elevate the water to two elevated jet condensers, which will be described later.

The condensers are set over a single or common hot well, from which the supply of feed-water is taken by a Worthing-

ton tank pump, and passed to the treating plant, so that there will be an ample supply of luke warm boiler feed-water when either condenser is running. When both condensers are out of service the six-inch suction leading directly to the tank pumps from the intake well is to be used, or should this tank pump be disabled the feed pumps can pump directly from the intake well through this same six-inch suction pipe. Should it be desired either or both feed pumps can pump directly from the hot well to the boilers.

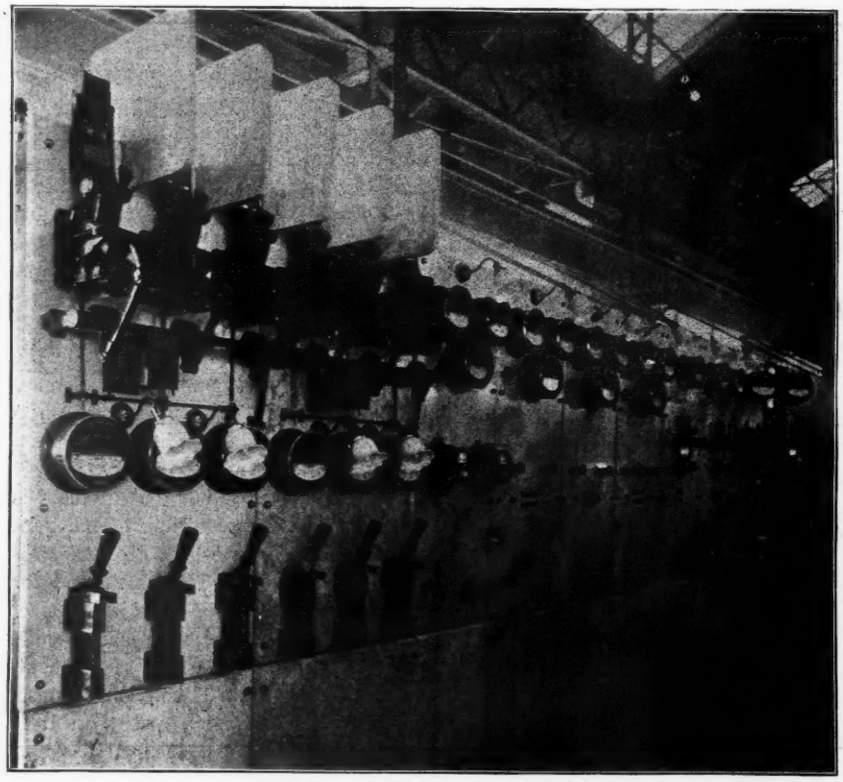


FIG. 3. SWITCHBOARD IN MAIN POWER-HOUSE, TOLEDO, NORWALK & FREMONT HIGH-SPEED ELECTRIC RAILWAY.

A feed water heating system was installed by the Wefugo Company, Cincinnati, Ohio, and consists of two large treating tanks with automatic stirring devices, operated by a small electric motor.

After the scale-forming ingredients have been precipitated by introducing the chemical reagents and the bulk of the sludge allowed to settle, the water flows through a large open filter, whence it is pumped to the boilers by two Worthington outside-packed, plunger, pressure-pattern feed pumps, having cylinders seven and one-half inches and 5 inches by 10 inches stroke of piston. This open filter tank is of Portland cement masonry, and is sunk in the ground until its top is flush with the top of the ground, and is equipped with the usual quartz sand filter bed, aluminum bronze strainers, wash pipes and stirring devices. The treating plant is intended not only to take care of the scale-forming properties of the water, but to prevent oil from entering the boilers from the hot well, as would be the case were the water pumped directly. The hot well contains such protecting baffles, and the feed suction is so arranged that there will be a constant tendency to get water containing the least amount of oil of any in the hot well.

Leaving the feed pumps, the feed-water will pass through an auxiliary heater, where it will receive the heat, which would otherwise be wasted by the auxiliary pumps and engines, thence through a fuel economizer to the boilers. The auxiliary heater was furnished by Baragwanath & Company, of Chicago, while the economizer is the regular Westinghouse, Church, Kerr & Company's circulating economizer and is built by the Green Fuel Economizer Company.

The feed piping is so arranged that the heater or economizer may be by-passed at will.

The boilers, which were furnished by the Babcock & Wilcox Company, are five in number, of the vertical header type, and each of 300 horse-power, nominal rating. They are built for a working pressure of 155 pounds per square inch. The boilers are equipped with Roney mechanical stokers and smokeless furnaces. The coal is fed to the furnaces by gravity from an overhead coal pocket of 500 tons capacity, and the coal handling machinery is so designed as to handle ashes and refuse from the firing floor into a bin over the cars on the side track, so that the fire room labor will be reduced to the minimum. A side track of the Wheeling & Lake Erie passes over the coal hopper and under the ash hopper, and transfers are to be made by gravity, with little labor expense. The coal handling system is composed of an endless chain of wheel and pan construction, and a heavy bunker of structural steel and masonry construction. The conveyor is being furnished by the Steel Cable Engineering Company, of Boston.

The coal and ash handling machinery is operated by a Westinghouse standard engine of 10 horse-power, nominal rating.

Draft is furnished by two vertical discharge fans of heavy construction, either of which is large enough to provide draft for the plant. These fans draw the waste gases through the economizer, or directly from the boilers as desired. They are of the extra heavy special construction found in all the fans used by Westinghouse, Church, Kerr & Company for mechanical draft purposes. These fans are directly connected to horizontal steam engines by marine couplings, so that all parts of the unit are readily accessible for purposes of adjustment or repair. The steam supply

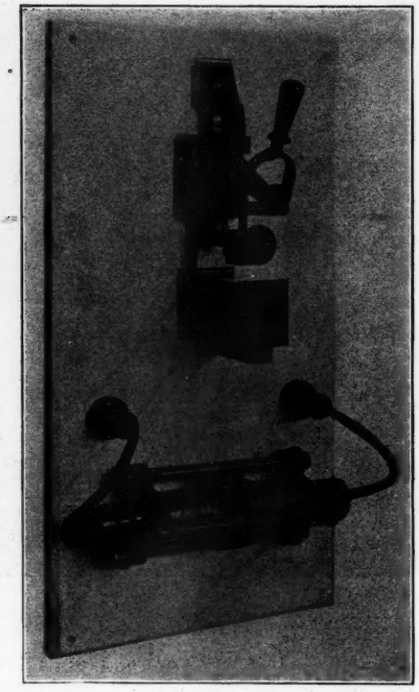


FIG. 4.—TIME-ELEMENT CIRCUIT BREAKER, TOLEDO, FREMONT & NORWALK RAILWAY.

for the fans is controlled by a regulator which regulates the speed of the fans to correspond to the requirements of the plant by increasing the speed when the steam pressure tends to go down, or *vice versa*.

The main steam piping is arranged on the "feeder and main" principle, the steam flowing from the boilers to the engines almost directly, so the main supply tends to equalize pressures and make up any deficiency. The main is divided into sections by valves, allowing any one boiler and engine to be operated should it be desirable to repair any other portion of the system. The high-pressure fittings are all flanged, of a very heavy pattern, and were furnished by Eaton, Cole & Burnham, of New York. The valves in the high-pressure lines, except the three 34-inch valves are of Chapman Valve Manufacturing Company's make. The 24-inch valves in the vacuum lines are being furnished by the Rensselaer Manufacturing Company.

The condensing apparatus consists of two 3,000 horse-power Worthington central elevated jet dry-air pump condensers. The injection, before entering the condenser, passes through an air cooler, coming in contact with a set of brass tubes, through which the air from the cone passes on its way to the dry-air pump. The air being thus cooled and dried is pumped under the best conditions for high efficiency, both as measured in vacuum attainable and in work required for pumping. Two dry-air pumps exhaust the air from the cones. These pumps are of the crank and flywheel pattern, with small clearances, and positively moved air valves especially designed for pumping to a very high vacuum with great efficiency.

The overflow from the hot well passes through a 20-inch glazed pipe to the river.

A traveling crane, of 20 tons capacity, manufactured by the Whiting Foundry Equipment Company, of Chicago, Ill., spans the engine room. A compressed air system has been installed for cleaning the electrical machinery. It consists of a Westinghouse Air Brake Company's standard air pump, storage tank, piping and nozzles for directing the air.

The power plant is designed to admit of ready extension without destroying the symmetry of its design.

In the engine room are to be installed four 1,000-horse-power, vertical compound engines, having steam cylinders 21½ inches and 37 inches by 22 inches stroke, built by the Westinghouse Machine Company. Each of the engines are to be direct connected to a 500-kilowatt, three-phase generator. The normal speed of these engines is 214 revolutions per minute. Each engine, with its generator, is mounted upon a single bedplate, insuring accuracy and permanency of alignment. Special devices are provided to enable the operator at the switchboard to vary the speed of any engine when in operation, and to divide up the load between the units as may be desired.

Excitation for the larger generators is

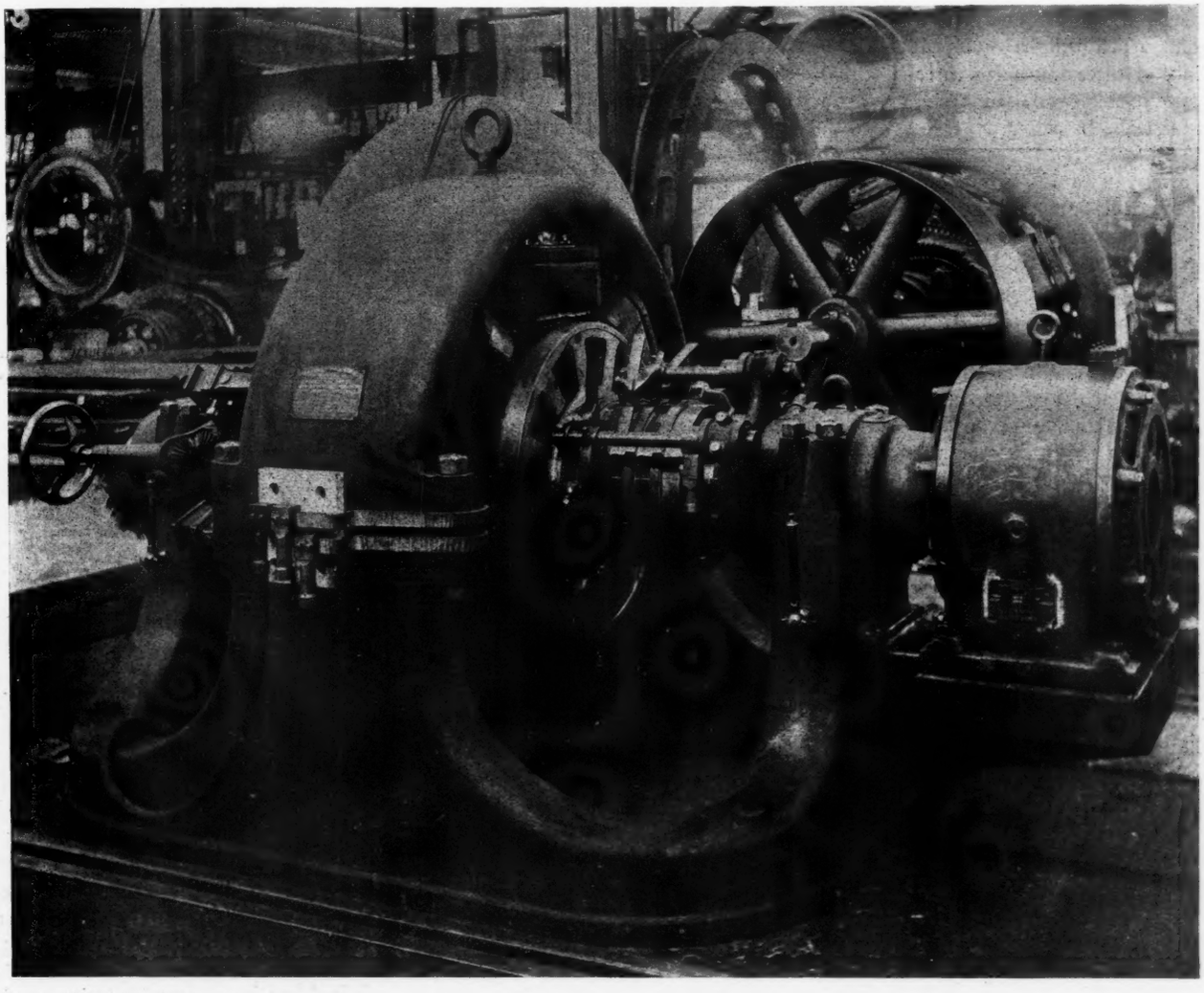


FIG. 2.—200-KILOWATT ROTARY CONVERTER FOR SUB-STATIONS OF THE TOLEDO, FREMONT & NORWALK HIGH-SPEED ELECTRIC RAILWAY.

provided by two 30-kilowatt multipolar direct-current generators, 125 volts, direct connected to two Westinghouse vertical single-acting, single-valve, 9-inch and 15-inch by 9-inch compound engines. Either exciter has sufficient capacity for supplying the main generators and for furnishing current for lighting the power station.

The feed wires will pass downward through the masonry floor of the engine room to the transformer room in the basement, which will be equipped with two banks of three transformers, each of 400 kilowatts, of the standard Westinghouse oil insulated, self-cooling type. A seventh 400-kilowatt transformer will be held as reserve. Two 200-kilowatt rotary converters will be installed in the central power house at Fremont, taking current direct from the main bus-bars, and supplying the continguous sections of the road.

The whole of the electrical apparatus is arranged to work in multiple. The four generators at the central station are multipled together, as well as the seven substations, so that whenever a heavy load arises on any part of the line all the substations assist each other to carry it.

The switchboard at the Fremont central station, for controlling the electrical machinery is very similar in design and construction to that for the Rapid Railway, of Detroit, except that the Fremont board has provision for four generators instead of three. To the right of the board, mounted on a swinging bracket, are two 600-volt, alternating-current voltmeters, one permanently connected to the bus-bars and the other to be connected to a generator when it is about to be thrown into the circuit, a receptacle on the panel of the switchboard being provided for making the connection to its voltmeter.

Two panels control the exciters and four panels the generators, each provided with the usual apparatus. The load panel carries three 6,000-ampere ammeters, and two single-phase integrating wattmeters. The latter are connected, so as to properly divide up the load on a three-phase circuit. Under normal conditions, each wattmeter will register half the load, and under all conditions the sum of the two readings will record the entire load. Each of the two panels on the left of the board controls a bank of three 400-kilowatt step-up transformers, and has mounted upon it a three-pole, 2,000-ampere, brush-type circuit breaker, with time element attachment. This time element principle has been widely adopted on power pressure plants by the Westinghouse Electric and Manufacturing Company. Its object is to prevent a short circuit on the alternating-current and direct-current lines at a point distant from the power house, opening any but the circuit breakers nearest it. If, for instance, a short circuit should occur at one of the sub-stations, it might trip the main circuit breakers in the feeders at the transmitting end, provided these were made to operate instantly, even before the circuit breaker in the one feeder at the receiving end could open or break the arc. This would cut off the current from all three of the sub-stations fed by this one high-tension circuit.

To obviate this difficulty, the circuit breakers at the transmitting end are provided with a time element attachment, so that they will only operate if the overload or short circuit holds for a certain length of time, the duration of time being capable of adjustment upon the apparatus, usually from three to ten seconds. In case a short circuit occurs beyond the breaker at one end of the sub-stations, that breaker opens almost instantaneously, and cuts off the current before the breakers at the transmitting end get a chance to operate, because the latter breakers possess the time element feature. Should a short circuit come across the lines between the two sets of breakers it will continue until those at the transmitting end open the circuit.

The construction of these circuit breakers follows the standard brush type, having a break on carbon contacts of sufficient length to open a circuit up to 750 volts. The armatures of the tripping magnets of the breakers are connected to the levers which extend downwards to the rectangular boxes containing its time element mechanism, which are seen mounted on the face of the switchboard below the two three-pole breakers. The time element is a spring motor mechanism, tending to drive a Foucault current disk between the poles of permanent magnets, acting similarly to the retarding mechanism, but is restrained from further motion of this mechanism is restrained by a pawl, which is mechanically connected with the tripping mechanism of the breakers.

Should an overload occur on either of the breakers, its armature moves a slight distance, releasing the spring motor mechanism, but is restrained from further movement until the spring motor runs a certain predetermined time, when, if the short circuit or overload still exists, the armature of the breaker being left free to move further, operates the tripping mechanism. The length of time during which the overload must continue in order to operate the breaker, is adjusted by moving the magnets on the retarding disk, as is done in adjusting the speed of an integrating wattmeter. All three breakers, one in each phase, are controlled by the same mechanism.

The high-tension side of each bank of three transformers is protected by means of three high-tension fuse circuit breakers. Each wire of the three-phase, 16,000-volt feeder is protected by a Wurts 16,000-volt lightning arrester.

A separate six-panel switchboard is provided for the control of the rotary sub-station at Fremont. The two right-hand panels control the alternating-current side of the 200-kilowatt rotary converters. The two centre panels control the railway feeders, and the remaining panels control the direct-current side of the rotaries. These rotaries being connected to a common bus are protected by means of fuses between the main switch and the rotary on the alternating side.

At each of the six rotary sub-stations, situated at Toledo, Genoa, Hessville, Clyde, Bellevue and Monroeville, there are two 200-kilowatt rotary converters and three 150-kilowatt step-down transformers, and a switchboard similar to that just described. The high-tension side of the transformers is protected by fuse circuit breakers and Wurts lightning arresters in each wire. The direct-current feeders and trolley lines are connected at each substation through controlling apparatus on the switchboards, so as to localize line troubles.

There are several features of interest in the electrical equipment of this line; for instance, the generators work at low voltage, so that the rotaries at Fremont can be connected directly to their bus-bars without the intervention of transformers. The time element circuit breakers have already been described. Loops are brought out on the step-up transformers to effect different ratios of transformation, so that the voltage on the secondary side of the banks of step-down transformers in the sub-station, and consequently the direct-current voltage on the rotaries may be equalized in different sub-stations in spite of the fact that the sub-stations most distant from the central station will have a lower line voltage on three-phase transmission than those that are nearer.

The generators are synchronized with the bus-bars by means of lamps and shunt transformers, following the standard method. The rotary converters are synchronized by means of lamps connected across the jaws of the main switch, connecting the alternating-current side of the

rotaries to the alternating-current busbars. Upon the end of the shaft of each rotary is an induction motor for starting purposes, the induction motor being connected to a three-pole, double-throw switch on the alternating-current rotary panel. The outside rows of the studs on these double-throw switches are connected to the transformers, from which loops are brought out so that when the three-pole switch is thrown in one direction a certain voltage will be thrown on the starting motor, and when thrown on the other side a higher or lower voltage will be put on the starting motor. Thus, in one position of the switch, the starting motor gives its speed slightly above the synchronous speed before being thrown in. After being synchronized on the alternating-current side, the incoming rotary is brought up to the voltage of the rotary already running, and then thrown in multiple with it.

The high-tension current is carried by three bare copper wires, arranged in the form of an equilateral triangle, one wire on the top of the pole, and one upon each end of the cross arm, the wires being 24 inches apart. Six feet below the cross bar is a bracket for carrying the trolley wires. Upon the opposite side of the pole, slightly above the bracket, are the direct-current feeder cables. The trolley wire is No. 000. The direct-current feeders vary from 400,000 circular mils to No. 0 wires.

The track, which is single, with turnouts, is constructed in a thoroughly first-class manner, the roadbed following the best steam railroad practice. Cedar ties are used, ballasted with gravel and stone, Carnegie 75-pound T rails are employed, with Forest City Electric Company bonds, and cross bonds every 500 feet.

The rolling stock is being provided by the Barney & Smith Company, of Dayton, Ohio, who are building 22 50-feet passenger cars, each equipped with two 75 horse-power motors, sufficient for a speed, upon a straight level track, of 50 miles an hour. These cars are 39 feet 3½ inches long over the body, 49 feet 5 inches long over the platform, and 8 feet 6 inches wide. There are 15 windows on each side. The cars are sheathed on the outside the same as a standard passenger coach. The wood for inside finish is quartered oak and the glass in the windows is double-thick French. The curtains are of printed duck with Forsyth curtain fixtures; three-ply oak veneer handsomely decorated is used for head-lining. The seats are upholstered in crimson plush, and the trimmings are of solid bronze. The cars will be warmed with Baker's "Mighty Midget" heaters, which have given excellent results on interurban railways, notably about Detroit. These car bodies will be mounted on the Barney & Smith improved Class F truck, especially designed for heavy service. Spoke wheels 36 inches in diameter will be used in the trucks, with axles of hammered iron 5⅜ inches in diameter. The trucks will be equipped with inside hung brakes. The cars will be handsomely furnished, and have a seating capacity for 50 passengers. Westinghouse air brakes will form part of the equipment. The sub-stations will serve as points for the collection and distribution of freight, it having been found by cross-country electric railways that a well-paying freight business may be developed through the facilities for prompt delivery. Mileage books for 1,000 miles will be sold for $12.50, and the local fares will be about one-half of those charged by steam railroads.

Death of Winthrop Thayer.

Winthrop Thayer, president of the firm of Thayer & Company, steam boilers, and well known in athletic and yachting circles, died July 19, in Boston, at the age of 37 years and 8 months. Winthrop Thayer was born in Boston, November 23, 1863, and was the son of the late Charles F. Thayer. For 15 years he was the New England manager of the Babcock & Wilcox Company, leaving that firm four years ago to take the presidency of Thayer & Company. A widow survives him. There were no children. Mr. Thayer was prominent in social and club life, being vice-commodore of the Hull-Massachusetts Yacht Club and a member of many clubs and organizations, among them being the Boston Athletic Association, the Newton Club, the Algonquin Club, the Manhattan and Engineers' clubs, of New York, the American Society of Mechanical Engineers. Mr. Frank A. Thayer, of New York, is a brother of the deceased.

PERSONAL.

Mr. J. E. Woodbridge, formerly editor of the *American Electrician* and lately engaged in electrical journalistic work, has left the field of journalism to enter the railway engineering department of the General Electric Company, at Schenectady. Mr. Woodbridge's many friends in New York will regret his removal, but congratulate him upon the congenial opportunity for the display of his great ability presented by his new position.

Mr. Fred C. Timpson, well known in electrical circles, who has been in Porto Rico the past year, is visiting New York. Mr. Timpson represents the Porto Rico Company at Ponce. The company has a large brick factory and controls the gas plant of that city, and is installing an electric light plant. The company also owns the ice plant of the city. Mr. Timpson also has charge of the electric light plant at Mayaguez. He reports quite an interest in electrical work, and thinks Porto Rico will develop very rapidly.

An Unusual Railway Accident.

An open car on the Madison avenue underground trolley line, in New York city, caught fire in the evening of July 21, after a subterranean electrical disturbance, and seven passengers were injured. Witnesses of the accident believe that the car was struck by lightning, as a terrific thunderstorm was in progress at the time. Just after the car had crossed Eighty-third street the fuse blew and a short circuit occurred under the car. A sheet of flame swept up from the ground over the side of the car and played about the roof; then a thunderclap came and the frightened passengers jumped to the street. The motorman stopped the car within its own length, but by that time seven persons had been hurt, many of them being burned by the stray current. The accident has not been satisfactorily explained except on the lightning theory.

Praise From Sir Hubert.

[*From the Electrical Review, London.*]

Journals, like individuals, sometimes get credit for things they have never said or done. For our own part we feel very conscientious on this point, as we are believers in the old maxim, "Honor to whom honor is due." We prefer to bear just that measure of honor which is really due to us and no more. Now the *Electrical Review*, of London, and the ELECTRICAL REVIEW, of New York, are not one and the same. Far be it from us to attempt a comparison, but because our contemporary bears our title it does not follow that we ought to be showered with the fruits of its victories. Our contemporary is quoted in the American daily press far more than is any English technical journal in the English newspaper press, and sometimes its striking articles are, in the course of events, copied into English papers without the necessary indication that the comments are those of the New York paper. It is easy thus to see that we are saddled with undeserved kudos, and our contemporary is robbed of its merited laurels.

SCIENCE BREVITIES

Penetration of Radium Rays—H. Becquerel has shown that the transmission of radium radiation across a screen is attended by several distinct phenomena: selective absorption, diffusion, emission of secondary rays, some of which are deflected by a magnet, while others are not; and, finally, a direct transmission of part of the radiation from the source. The transmitted portion appears to be identical with the incident radiation, and suffers the same deflection by a magnetic field. This identity has been doubted by Villard on the ground of some experiments, which seemed to show that the transmitted beam consists of rays which are not deflected by a magnet, while the deflected rays behave like cathode rays, and emerge at right angles to the absorbing surface. Becquerel has therefore repeated his experiments in a modified form. He employed a linear source of radium rays, consisting of a lead block with a furrow containing a radium preparation. A copper wire was placed a few millimetres above the furrow and parallel to it. Above that again was placed a sensitive plate wrapped in black paper, and the shadow cast by the copper was photographed with and without a magnetic field. Under the influence of the latter, with its lines of force parallel to the copper wire, the rays describe circular arcs of slight curvature, and, by reversing the field, two shadows may be obtained which are displaced with respect to each other. When a sheet of aluminum is introduced, either above or below the copper, these two images are obtained in the same manner, showing that the rays transmitted by the sheet are also deflected by a magnet. Villard's contrary result is probably due to a peculiar effect of the edge of the screen, says an *Electrician* abstract, which has been fully accounted for by the author.

Transient Deflection of Cathode Rays—In 1896 Herr Jaumann described a peculiar experiment which has not yet been satisfactorily accounted for, says one of Mr. Fournier d'Albe's abstracts. He immersed a very highly exhausted vacuum tube in ordinary vegetable oil. The tube was provided with a single electrode, which served as a cathode, while the anode was outside the tube and in the oil. When the tube was working the approach of a charged glass rod apparently produced a repulsion of the beam of cathode rays and the fluorescent spot produced by it. This repulsion rapidly subsided while the glass rod was held in the same position. When the rod is removed, or when the charge is of the opposite sign, the repulsion becomes an attraction. M. P. Villard has repeated the experiment and verified the effects as stated, but he does not follow Jaumann in ascribing them to a peculiar property of the cathode rays, such as the "self-stretching" property which the latter connected with his hypothesis of "longitudinal light." The author points out that commercial oils are very poor insulators, whereas true dielectrics have been shown by Bouty to intercept an electrostatic field as effectively as a layer of mercury. Consequently, the electrostatic field produced in the interior of the tube by the glass rod outside depends upon the conductivity of the oil, and if the oil takes some time to adjust itself to an external field, there will be an electrostatic process within the oil which may well last a second. Such a process would explain the temporary deflection of the cathode beam described. In confirmation of this explanation, M. Villard replaces the cathode beam by a conductor joined through a screened wire with an electroscope outside. A temporary deflection of the electroscope is then observed, corresponding to the deflection of the cathode beam.

Atomic and Molecular Magnetism—Some further interesting work has been described by Herr S. Meyer, in the *Annalen der Physik,* on the atomic magnetism of the elements and the manner in which it is effected by the combination of atoms to form molecules. Measurements made with vanadium chloride show that it is a somewhat feebly paramagnetic substance of susceptibility about one-quarter of that of nickel. Provisionally, it may be placed at the beginning of the series of susceptibilities of the iron elements discovered by the author, thus

V: Ni: Cr: Fe[1]: Co: Fe: Mn = ½: 2: 2½: 3: 4: 5: 6,

says a British contemporary. Studies of gadolinium and samarium make it appear likely that both these metals contain traces of a new substance of very high susceptibility. This new element is revealed in the spectrum, which shows a large number of lines, and this, as we know from the author's researches, invariably indicates a high susceptibility. Special attention was devoted to the salts of copper. Previous work had shown that in some diamagnetic compounds the molecular magnetism shows a greater diamagnetic value than would correspond to the sum of atomic magnetisms. This happens in every case where the combination is accompanied by a considerable expansion, as in the iodides of silver, mercury and lead. This suggests that the converse might occur in the case of contraction of volume, and for this investigation the salts of copper, with their very small susceptibilities, are specially valuable. Measurements made on a number of copper salts show that there is no fundamental difference between cupric and cuprous salts in Wiedemann's sense, since both the sulphides are equally diamagnetic. But the influence of volume changes is very decided and regular. Volume expansion increases the diamagnetic character of a substance, and contraction emphasizes its paramagnetic character. The magnetic properties of the elements can, therefore, only be deduced from the elements themselves, or from compounds which undergo no change of volume during their formation.

Vacuum Electroscope—In a recent number of the *Elektrotechnische Zeitschrift* there appears a description of a vacuum electroscope which has been constructed for experimental purposes. The apparatus has the form of a pear, about four and one-half inches in length, its top consisting of a hollow aluminum ball, which rests upon an aluminum wire welded into the glass. This wire projects into the interior of the electroscope, where it takes the form of a flat ribbon, to which the broad pendulum leaves are attached, these latter being of aluminum foil about two-fifths of an inch long and three-fifths of an inch broad. In the lower portion of the glass bulb are two platinum wires welded into the sides of the bulb very close together. Experiments with the instrument proved the vacuum to be a perfect insulator, and that delicate electrostatic effects might be obtained with it. The ordinary electroscope experiments succeeded when applied to the apparatus, though the heavy charges on the glass walls, which occurred during these experiments, had a disturbing influence. When the apparatus was observed in a dark room, no trace of luminosity was apparent in it during the occurrence of strong electrostatic effects, says a British contemporary. Discharges of electricity into a vacuum are therefore dark, from which it may be concluded that the phenomena of light are dependent upon the presence of material such as would be found in air.

The taxpayers of the village of Fairport, N. Y., recently voted the sum of $20,000 for the construction of an electric light plant to be owned and operated by the village, in connection with its waterworks system.

A Theory of the Coherer.

To the Editor of Electrical Review:

My attention has been attracted by the various theories of the action of the coherer, among them some attributing its action to molecular changes in the particles used in the coherer. I think the action is simple and can be put in simple language. In the first place, when two points are used between which sparks pass they become tarnished or covered with deposits, some metals more than others. The points on the negative side become more tarnished than the one on the positive, and the sparks do not pass as well as when they are bright.

If the points are shifted when tarnished, the positive to the negative, and the negative to the positive, the resistance to the passage of the sparks is increased. Gold points tarnish less than any other metal that I have tried. When a piece of cardboard is covered with a gilding solution and the solution connected so electric impulses can pass across its surface, there occurs, at first, a series of sparks across the shortest distance between the connecting wires; they can be seen without a lens, the only requisite being a darkened room. The sparks soon cease to pass the shortest route, and some pass around distant places, showing that partial connections are being permanently made, which is also shown by a galvanometer and battery connected up with the solution on the cardboard after having been subjected to the action of the electric impulses.

It has been stated that some particular particles when used in a coherer cause an increase of resistance to the passage of a current when electric waves pass into it, which from the tarnishing of the points mentioned above would be anticipated on the surfaces or sharp edges of the metal or whatever used that produces that effect, becomes tarnished more easily than others that make the partial connections, and they produce an increased resistance instead of a reduced one.

That there would be a movement of the fine, loose particles would also be anticipated, as the sparks passing into the coherer would have some mechanical force, the same as they exert on other arrangements.

That the sparks would act on the loose particles in the coherer, as regards tarnishing their surfaces, can not be disputed. If they act thus on pointed wires, why not on fine particles? Electricity is always consistent in its action; there is nothing about the particles different from the two pointed wires, excepting a multitude of fine points, sharp edges and surfaces close together, instead of the two points. The tarnishing, deposits and heat, caused by the passage of sparks, lightly connect or weld together some metallic particles, while others are tarnished so that they do not all connect together alike, which would account for some impulses causing a reduced resistance over that of other impulses which are greater. I think the above explains the action of the coherer in a simple manner.

Alfred G. Dell.

Baltimore, Md.

Tests of Automatic Street Railway Brakes.

The New York state board of railroad commissioners has issued a report on the official tests which it has made of automatic brakes for street surface railroad cars, to take the place of the old hand brakes with which a majority of the cars operated in the state are now supplied. In its report the board says:

"The board has devoted much time to this test, and, while nothing has been brought forth that will revolutionize the manner of stopping a car, the opportunity is afforded to present to the railway officers and to the public facts and figures showing what the best appliances known to-day can do in the matter of stopping a car quickly. While these results are very satisfactory, there is still room for much improvement, and the board feels that its action in holding a public test will result in still further improvements in brakes or in new inventions which will reduce the distance within which a car can now be stopped, and it has the satisfaction of knowing that it has done all in its power to bring about the adoption of better brakes than those now used by the majority of roads in this state and, and thus reduce the number of accidents.

"After carefully considering the various points in each system and adding to or taking from the mechanical standing of the different brakes, as given in the report of the electrical experts, the board gives the several brakes the following final standing in the order of their respective merit: The Electric Selector and Signal Company; the Peckham Motor, Truck and Wheel Company; the Sterling Supply and Manufacturing Company; the G. P. Magann Air Brake Company; M. H. Vogel; the Devlin Street Car Brake Company; the J. G. Brill Company; the Sauvage Street Car Brake Company; the Standard Air Brake Company; the Christensen Engineering Company; the General Engineering Company; the General Electric Company; J. E. Reyburn; the Columbia Car Light and Brake Company; Price, Darling & Company; the Safety Appliance Company; Bach & Schlegal.

"It is not the intention of the board to recommend any particular brake for any class of service, leaving the selection to the judgment of the railroad officers themselves. The board will, of course, exercise fully its power under the law to require of the companies the use of sufficient and safe equipment for the public service. After a careful consideration of the whole subject of brakes for electric cars, the board has determined that, except in special cases where the liability of accident is very remote the ordinary single chain and spindle hand brakes now generally used, should be replaced by brakes made by one of the following manufacturers, or any other which, in the judgment of the board, is hereafter shown to be equally efficient.

"Air Brakes—the G. P. Magann Air Brake Company; the Standard Air Brake Company; the Christensen Engineering Company; J. E. Reyburn. Electric Brakes—the Electric Selector and Signal Company; the General Electric Company. Friction Brakes—the Peckham Motor, Truck and Wheel Company; the J. G. Brill Company. Hand-Power Brakes—the Sterling Supply and Manufacturing Company; M. H. Vogel; the Sauvage Street Car Brake Company."

Visit of the American Institute of Electrical Engineers to London.

It is stated by the secretary of the British Institution of Electrical Engineers that the members of the American Institute will be offered a trip up the Thames in electric launches, on Sunday, August 12, the visitors and their hosts leaving by a morning train for a starting point at a convenient part of the river, and returning the same way, after lunch at a waterside hotel. On the evening of Monday, August 13, they will be entertained by the president (Professor Perry) and members of the Institution at a dinner in London. On Monday and Tuesday special visits will be arranged to works and places of interest in the neighborhood of London; particulars of these visits will be found awaiting American guests on their arrival in England. Members of the American Institute who will be in London at the time of the visit are requested to place themselves in communication with the secretary of the Institution of Electrical Engineers, No. 28 Victoria street, London, S. W., to which address they are also invited, if they care to do so, to have their mail forwarded.

For the joint meeting of the American Institute and the British Institution of Electrical Engineers, in Paris, the following is announced as the title of the subject selected for discussion, on August 16: "The relative advantages of alternate and continuous currents for a general supply of electricity, especially with regard to interference with other interests."

ARC LAMP DISTRIBUTION.

BY ALTON D. ADAMS.

Series arc distribution has long been one of the most unsatisfactory features of central station service, from an engineering point of view. In generating plants of the older types, the undesirable elements incident to the operation of arc lamps in series begin at the dynamos. As is well known, the series arc dynamo is, per necessity, a machine of small capacity, and this capacity has remained nearly stationary at hardly more than 100 horse-power during some years.

Constant-pressure dynamos, starting 20 years ago with small sizes, similar to the arc machines of that period, have since advanced to thousands of horse-power capacities in single units. Very decided advantages as to efficiency, floor space, reliability and the labor of attendance have been thus gained for constant-pressure equipment at the station, over constant-current dynamos. Reasons for the small capacities of series dynamos are found in the character and requirements of their usual loads. Arc lamps for street lighting are very generally supplied from series circuits, as are also many in commercial service. The terminal voltage for arc lamps of a given type is very nearly constant for all candle-powers, and the current must be varied to give the light required. Arc lamps of the power desired for ordinary street lighting and commercial use require from 5 to 10 amperes, and their series circuits are therefore limited to these currents. Even with 10 amperes, the energy that may be distributed on a single series arc circuit is quite small in amount, since the limits of practicable pressure are soon reached.

Insurance rules, the difficulties of line insulation, danger to persons and troubles incident to commutation are among the main causes that limit the voltage of series circuits for arc lamps. As no circuit having a pressure of more than 3,000 volts may enter or even pass over buildings, except generating and sub-stations, commercial arc lamps are excluded from circuits above this pressure. A great majority of street lamps are operated on overhead lines; with pressures much above 3,000 volts and the common degree of insulation on these lines, the amount of leakage is such as to seriously interfere with operation in wet weather. In some cases where the attempt to operate series arc circuits at about 6,000 volts has been made, the low resistance of line insulation has shunted sufficient current from the more distant lamps to prevent their satisfactory service and a return has been made to about 3,000 volts for the maximum pressure.

High-pressure, constant-current circuits have proven particularly destructive of life, and, in the absence of definite statistics, it seems highly probable that more persons have been killed by accidental shocks from arc lamp lines than by those from all other sources combined. There is little reason to doubt that a large increase in the voltages of series arc circuits would materially heighten the fatalities on such lines. Whatever may be done to increase the safety and capacity of constant-current circuits for high voltages, the limits of satisfactory commutation as to pressure at the arc dynamo are apparently not far above present practice. In most cases where more than 4,000 volts have been employed on a single line of series arc lamps, the high pressure has been obtained either by connecting two or more entirely independent arc dynamos in series or else by the use of a special type of dynamo having two or more separate armature windings and commutators, with series connection between them. Whatever the practicable increase of pressure on series arc circuits, therefore, it appears that the arc dynamos for constant current must remain a machine of small capacity, or, what amounts to nearly the same thing, so far as care, efficiency and floor space are concerned, a combination of machines of small capacities. In general, a glance at the conditions of arc lamp distribution on series circuits is sufficient to show that for any voltage within the ordinary range of practice in central station supply the energy for a single circuit must remain small. Thus with 10 amperes, the largest constant current in common use for arc lamp lines, a voltage of 3,000 corresponds to 30 kilowatts, and even 10,000 volts would require a dynamo capacity of only 100 kilowatts. The later development of arc lamps, as to the enclosure of the arc in gases largely evolved from the carbons, is very satisfactory for their greatly increased life. As the lamp voltage has also been increased from about 50 to 80 or more by the enclosure of the arc, the total watts remaining nearly as before, the number of independent circuits must be raised, or a higher voltage used for each. Since enclosed arcs are largely displacing the open type for street lighting as well as interior use, the disadvantages of constant-current distribution are further increased by this important improvement in arc lamps. Aside from the limited capacities of arc dynamos and their circuits, the constant-current method of distribution has other unsatisfactory features that are inherent in the system on whatever scale of magnitude it is carried out. The current of each lamp passes through every other, on the series system, so that the failure of any lamp to close the circuit puts all of the others on that line out of use. That open circuits on series arc lines result in material interruptions of the service, in spite of automatic devices, is well known to those personally familiar with their operation.

Every successful dynamo for the operation of arc lamps in series is supplied with some form of automatic regulator, with a structure independent from that of the machine. These means of regulation for varying loads add to the care for, and decrease the reliability of constant-current machines. In a dynamo delivering constant current at a variable voltage the losses remain nearly constant for all loads, so that the efficiency of such a dynamo drops faster for partial loads than is the case with constant-pressure machines. To obtain good constant-current regulation it has been found necessary to design the armature and magnet windings of series arc dynamos for much larger losses than are usually found in machines of other types. Inherent designs and conditions of operation thus combine to give arc dynamos a low average efficiency. The case for dynamos is no worse than for their circuits which distribute energy by constant currents. On constant-pressure lines the loss of volts varies directly with the load and the watt loss, consequently as the square of the load, thus giving a percentage of energy loss that changes as does the load. Constant-current circuits have a uniform pressure and watt loss whatever the load, so that the percentage of loss varies inversely as does the load. To take an illustration, a loss of 10 per cent at full load, on a constant-current line, becomes 20 per cent at one-half and 40 per cent at one-quarter load, the actual loss being the same for each. On a constant-pressure distribution line with 10 per cent as a full load loss, the loss at one-half load is five per cent, and the consumption of energy in conductors only one-quarter of the amount at full load. For equal energy, voltage and distance the weight of conductors with a given percentage of loss at full loads is the same for both the constant-current and constant-pressure distribution. As electric circuits usually work under partial loads during much the greater part of the time, the average percentage of loss is an important matter, in which the constant-pressure systems have a large advantage. It should be noted that the losses pointed out for constant-current circuits are inherent in the system and can not be changed by any improvements of machinery or generating equipment.

The unsatisfactory results as to flexibility, economy and reliability of engine-driven arc dynamos have led to other station equipments for the production of con-

stant current. One of the expedients now in use at stations having main constant-pressure generators, is to drive regular arc dynamos by transformers and motors which take their energy from the main generators. The disadvantages of this plan are the investment in electrical machinery having a capacity of more than four units for each unit of delivery capacity to arc lamp lines, the low combined efficiency of main generators, transformers, motors and arc dynamos, and the space and attention required for all of this equipment. It may well be doubted whether the increased economy of steam engines, with the equipment last-named, is sufficient to offset the large interest and depreciation charges on, and the low combined efficiency of, the electrical machinery. Another plan for the operation of series lines for arc lamps, from stations with main constant-pressure generators, includes transformers for the production of constant current on lines with alternating arcs. If the arc lamps require a direct current, a rectifier must be used in connection with the constant-current transformer. The constant-current transformers, either with or without rectifiers, should be cheaper as to first cost and more efficient as to operation than the combination of transformers, motors and arc dynamos, and the attention necessary for them is certainly no greater, so that the former are preferable.

What seems to be the best possible modification of present general practice in the operation of series arc circuits, thus avoids only a part of the station disadvantages and leaves all of those that relate to the distribution system as before. If a method for the supply of arc lamps over large areas can be devised, that will either clear the station and system of special equipments for constant-current production, or will do away with the large number of series lines now necessary, a decided advantage will be gained. The ideal system of arc lamp operation is obviously that on which they are supplied from the same system of distribution to which incandescent lamps and motors are attached. Thousands of arc lamps are already operated in this way on low-pressure incandescent circuits, and it seems that constant-pressure lines might be arranged for all arc lamp service, with a decided advantage over all of the series systems. The difficulty that at once comes up, when an attempt is made to extend arc lamp service on constant-pressure lines beyond their present limits, in the usual way, is the increased weight of conductors. Alternating lines of high pressure can be erected to the localities where arc lamps are wanted, at moderate expense, but the problem is to apply the energy of these high pressure lines to arc lamps, at constant pressure, with a small outlay for conductors. If transformers, connected to the high-pressure lines, are employed to deliver low-pressure energy to secondary circuits of the voltage and proportions common with incandescent lamps, for arc street lamps either many transformers, each of small capacity, must be used or else the secondary circuits must each serve a greater area than is consistent with economy of copper. Circuits, designed purely for the distribution of arc lamps at constant pressure, are not limited to the voltage of incandescent lamps, neither is the drop of pressure in such circuits controlled by the condition of incandescent service. Either opened or enclosed arc lamps may be operated on constant pressure circuits, the former usually requiring about 45 and the latter 80 volts at the arc. Each type of lamp requires more or less external resistance in its circuit when connected to constant pressure lines, but the amount of this resistance in each case depends on the voltage of the mains, the number of arc lamps joined in series and the construction of individual lamps. Arc lamps may be connected to constant pressure service singly, or a number may be joined in series and the two free ends of the series then joined to the mains, a suitable resistance being placed in circuit with the lamps for each case. As constant pressure circuits have not usually been designed for arc lamp distribution, their voltages are not those best adapted to that purpose. For economy of operation it is obviously desirable that only so much external resistance as is necessary to steady light be connected in circuit with arc lamps. The resistance in each case, however, must be sufficient to cause a drop between its terminals equal to the difference between the necessary lamp voltage and that of the mains, when the full rated current is flowing. It can not be broadly stated just what per cent of the total line voltage should be taken up by the external resistance with arc lamps on constant pressure mains, until the factors for each case are known. Usually the steady operation of lamps requires that from 10 to 20 per cent of the energy drawn from lines at constant voltage be consumed in external resistance. The 110-volt pressure common on mains for incandescent lighting is, therefore, 10 to 20 volts higher than is necessary for single enclosed arcs. Constant pressure circuits exclusively for arc lamp supply, should be designed for just the pressure desirable to give steady operation, and thus avoid any unnecessary expenditure of energy in external resistance. The number of street lamps that should be connected in series, and consequently the voltage of constant pressure lines for arc service, depends largely on the distances over which the distribution takes place. If transformers, on the high pressure alternating lines, deliver current at 500 volts on the secondary circuits, these circuits will involve only a moderate cost for the ordinary distances that they would cover. Whatever the voltage selected for the secondary lines, their weight may be held at very low point by such proportions that they include all of the external resistance necessary to steady operation at the lamps. A little consideration makes it appear idle to expend large sums in order to hold the loss in constant pressure lines for arc lamps at a low figure, and then to insert an external resistance that involves a large drop of voltage in the lamp circuit. In order that the resistance of distribution lines may be effective to secure steady operation at the lamps, the necessary resistance for regulation must be in the independent circuit of each lamp or series of lamps. This requirement follows from the fact that the regulation obtained by a resistance in the lamp circuit is due to the increased drop of pressure between the terminals of the resistance, when more than the normal current flows. Unless the regulating resistance is included in the separate circuit of each lamp or series of lamps, the flow of current, due to changes in the length of any one arc, will effect the drop between resistance terminals but little A desirable arrangement for street lighting therefore includes as many circuits from the secondary terminals of each transformer as there are separate lamps or series of lamps to be operated by it. The conductors for each lamp or series of lamps should be given nearly the resistance necessary for good regulation, and then a small variable resistance connected in each circuit. Compared with the systems of series distribution to arc lamps from stations with main, constant pressure generators, the method of constant pressure distribution just outlined is superior in nearly every particular. A station equipped with high-pressure alternating dynamos is entirely free, on this last plan, from any auxiliary equipment for arc lamp circuits.

The same distribution lines to which transformers are attached for service to incandescent lamps and motors are also available for the transformers that supply the arc lamp circuits. These transformers for the arc lamp lines have no special complicated or moving parts, but are the same in every particular as those used for incandescent service. In fact the only part of the system that now has any special adaptation to fit it for arc lamps is the comparatively short secondary lines between them and their transformers. The adoption of this constant pressure system of distribution to arc lamps will have the advantage over any of the series systems, of higher efficiency, lower first cost and greater simplicity as to the generating machinery, the absence of a large number of small lines entering the station, the economy in conductor losses incident to constant pressure distribution, and a very material reduction in the element of danger from handling arc lamps. It may be objected that the 10 to 20 per cent loss of energy, that must occur for purposes of regulation in constant pressure lines for arc lamps or in their special resistance coils, is a serious objection to arc lamp distribution at constant pressure. The increase of efficiency at generating stations and in the high pressure lines can readily be shown, however, to much more than offset the loss necessary for the regulating resistances. Static transformers, delivering alternating currents, have thus far been suggested, but if direct current is desired for arc lamps, rotary transformers, located at suitable points, may be used to displace the static type, leaving all other parts of the system as before. The rotary transformers require a minimum of attention, and their main disadvantages, compared with the static type, are a higher first cost and a lower efficiency.

Some Modern Types of Direct-Current Generators.

The progress of the dynamo machine in its development was so rapid that it seems almost to have appeared complete and finished upon the scene of its operations, and as if the electrical principles well known several years ago could scarcely be further improved with advantage. It is, therefore, in the perfection of their mechanical design that improvements are now being made in electrical generators, although occasionally an innovation of decided merit is made in the electrical design. One of these is embodied in the machine which is here illustrated, and which is the Lundell generator as now improved and manufactured by the Sprague Electric Company, of New York city.

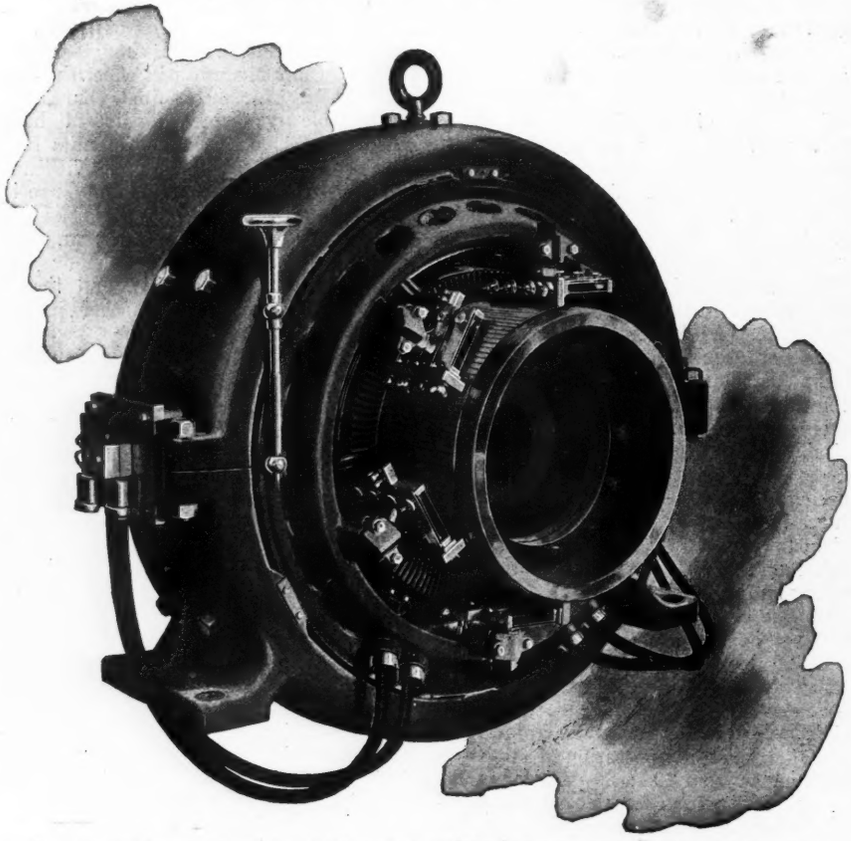


FIG. 1.—A MODERN TYPE OF 100-KILOWATT 125-VOLT GENERATOR FOR DIRECT COUPLING TO AN ENGINE.

Fig. 1 gives a general view of a 100-kilowatt, 125-volt engine type generator, adapted for operation at 260 revolutions per minute. This machine possesses several points of difference from the ordinary design which are of great interest and value. One of the most frequent sources of trouble and difficulty in dynamos and motors has been the brush-holder mechanism. In these machines particular attention has been given to the construction of the brush holders and rocker arms; Fig. 2 shows views of the type of brush holder in use. Carbon brushes are employed on the machine here illustrated, since it is considered that experience has already proven the life of a commutator to be very much longer with such brushes than with any other kind. The brush holders are mounted in a ring-shaped rocker arm, which is well shown in Figs. 3 and 4, giving respectively front and rear views of it. The illustrations tell their own story and show how substantially and solidly the brush holders are attached and what careful attention has been paid to the detail of the design of this important accessory part of the machine.

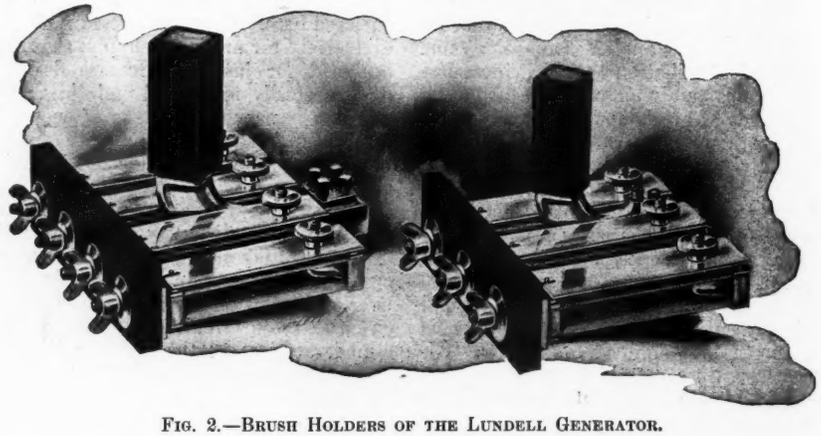


FIG. 2.—BRUSH HOLDERS OF THE LUNDELL GENERATOR.

The most interesting and important feature, however, of these dynamos is the construction of their poles. To eliminate, as far as possible, the evil effects of armature reaction has been the aim of the designers. As every one knows, the current in the armature of a dynamo has an effect tending at the same time to cross-magnetize and to demagnetize the field poles. The demagnetizing effect may readily be compensated for by compound winding, but the cross-magnetizing or distorting effect, which tends to concentrate the magnetic flux of the pole piece at one edge is not so easy a matter to obviate. In these machines the difficulty is conquered by deeply slotting the sheet-iron punchings of which the field poles are made in a direction parallel to the magnetic lines of flow in them. On one side of the polar extension a shoe or tip is run out in the direction of rotation of the machine, thus giving to that half of the pole piece a much larger surface opposed to the armature than the other half has; the consequence of this is that that half having the extension becomes saturated before the other half reaches such high magnetic density, and any increase in magnetizing force appears principally as an increase in the magnetic density in the air gap under that part of the pole piece which does not carry the projection. The resultant magnetization of the whole pole surface thus seems to move in a direction opposed to that of the armature rotation with increasing magnetic effort in the field coils. This phenomenon is used to balance out the armature reaction and it is claimed that this result is accomplished with great satisfaction by this simple and highly ingenious means.

The machines are made in a number of types and sizes adapted either for direct attachment to engines or for belt driving.

CARO, MICH.—A new electric light company has been organized here, with W. J. Gamble as secretary and manager. It is proposed to put in a $10,000 plant with storage battery, etc.

American Engineers in England.

[*From the London Electrical Review.*]

During the past two or three weeks this country in general, and London in particular, have been visited by a large number of American engineers. We need hardly say how welcome they have been, and we may, to some extent, forgive our French neighbors for their attitude toward this country when we reflect that, as in 1889, the critical factor in fixing a visit of American engineers *en masse,* has been a Paris Exhibition. We wish, however, that such visits could be more frequent and that they could be reciprocated. We believe that fraternizing of this kind will teach both English and Americans how little is the real difference between the two great Anglo-Saxon empires and the best of their people.

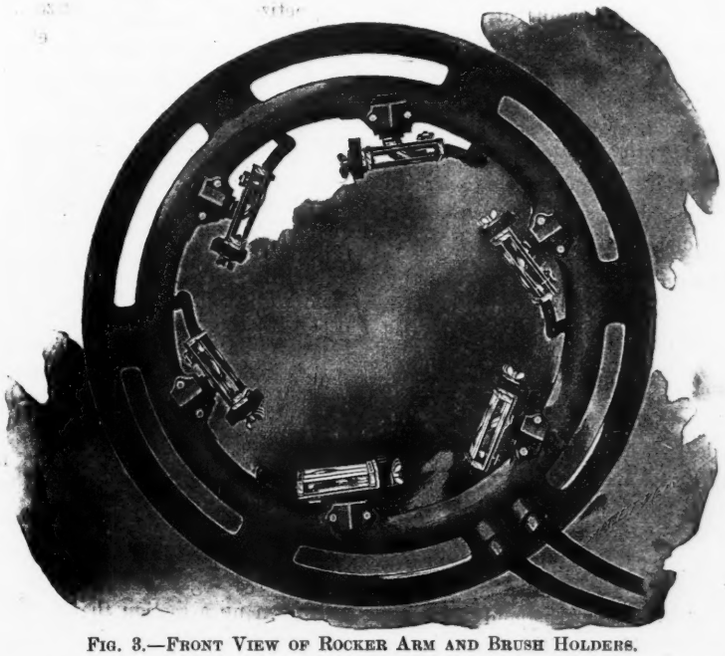


FIG. 3.—FRONT VIEW OF ROCKER ARM AND BRUSH HOLDERS.

In connection with the American Engineer's Convention in London, there was for a fortnight a round of visits and receptions, and none was better attended or more appreciated than that of July 3, when a large party was taken to Windsor by special Great Western train, and accorded the privilege of viewing the Castle —a special privilege, considering that Her Majesty was in residence. Moreover, in a sense, the freedom of the Castle was granted to the visitors, who were free to wander at will through the rooms and chapels, not being conducted by a guide in the usual way. Further still, Her Majesty provided refreshments in the Orangery, and, to crown all, drove slowly through the crowd assembled in the Park below the Terrace, and received the presidents of the American Society of Civil Engineers and the American Society of Mechanical Engineers, and extended a welcome in a few words. All our visitors were much gratified at this proof of Her Majesty's kindness and consideration, which, as we all know, never fail.

Our visitors were welcomed by the president at the reception of the Institution of Civil Engineers, which was held in the Guildhall of the City of London, and, despite the denseness of the crush, was a pronounced success. The Guildhall lends itself especially to such functions. Its library is replete with books and manuscripts and ancient charters, that record the history of our old city from its earliest times. A concert by the pupils of the Royal Academy of Music was held in the Council Chamber. The string band of the Royal Artillery played in the Great Hall, and there was vocal music in the Library and Art Gallery, the pictures in which are this year of, perhaps, more than usual interest.

Next to the day at Windsor, the excursion to Warwick and Stratford was, perhaps, most fully attended. A special Great Western train left Paddington, on Friday, July 6, for Warwick. The visitors were not only received by the Earl and Countess of Warwick, but were conducted through the Castle by the Countess herself, who, with the Earl, graced the luncheon table by her presence, and also spoke a few words of welcome. From Warwick the special ran forward to Stratford, and brief visits were made to the church, to the memorial theatre, and to Shakespeare's birthplace. We need not describe either Stratford-on-Avon or Warwick Castle.

To those who could appreciate it, the run home from Stratford to London was in itself a treat. It was drawn by the first of the latest class of Great Western engines, a monstrous engine with a huge boiler and Belpaire firebox. The visitors were looked after by Sir Douglas Fox in a most untiring manner. Space does not permit us to refer at length here to the week's previous entertainment by the Institution of Mechanical Engineers, to many pleasant incidents interleaved in the main programme, or to a private function to which we allude in another place; but we believe that such interchanges of ideas and hospitality between representatives of the two countries must necessarily foster a more brotherly feeling between them; and there can be no two opinions, but that the engineers and scientists of England and America are truly representative of the two greatest engineering nations of the world.

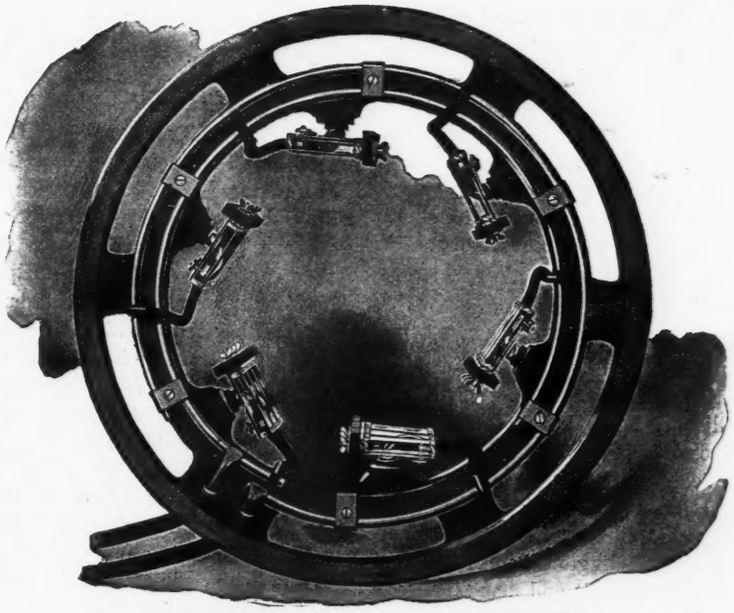


FIG. 4.—REAR VIEW OF ROCKER ARM AND BRUSH HOLDERS.

ELECTRIC RAILWAYS

The Massachusetts railroad commissioners have authorized the Palmer & Monson Street Railway to extend its lines into the town of Wilbraham.

President John A. Rigg, of the United Power and Transportation Company, has announced that the electric railway between Reading, Pa., and Boyertown, 20 miles, will be built at once.

The directors of the Milford, Mass., Attleboro & Woonsocket Street Railway Company expect to have the direct line from Milford to Woonsocket in running order by August 1 at the latest.

The Springfield, Mass., Street Railway Company will petition the state railroad commissioners for authority to increase its capital stock $700,000. The present capital is $1,500,000. The increase will be used to pay indebtedness and to construct new lines.

If plans do not go astray, the Miami Valley Electric Railway Company, of Dayton, Ohio, will construct an electric line from Dayton to St. Marys on state canal property. It is stated that the line in operation between Troy and Piqua will be connected with the one now under construction from the Gem City to Troy.

The work of transforming the Penobscot Central Railroad, in Maine, into a trolley system will begin early next week and will, it is believed, be completed within 90 days. The engineer representative of the firm of consulting engineers, under which the work will be done, is already in Bangor, engaged in the preliminary work preparatory to the opening of vigorous operations.

There is talk of the Camden, N. J., and Suburban Railway Company making negotiations for the purchase of the Camden, Ellisburg and Marlton turnpike for the purpose of running a trolley road from Haddonfield to Marlton, thence to Medford and Mt. Holly. This is one of he obnoxious old toll roads, the freeholders of Camden and Burlington counties having refused to purchase it and make it a free state road.

The stockholders of the Cumberland, Ind., Street Railway Company have elected the following directors: Senator George L. Wellington, J. A. McHenry, J. Wilson Humbird, J. Henry Holzshu, W. M. Roberts, Jr. The directors organized by electing the following officers: President, Geo. L. Wellington; vice-president, J. A. McHenry; secretary and treasurer, J. Henry Holzshu; superintendent, W. M. Roberts, Jr. It is stated that the company will make further improvements in their service the coming year.

The promoters of a street railway syndicate controlling electric railway systems in six different cities of Mexico, and having a capital stock of $2,000,000, have just completed the forming of the syndicate, which is to have its headquarters in Cleveland, Ohio, because the greater portion of the stock is owned by Cleveland capitalists. The railway systems in the six respective cities, each having a population of 100,000, are now being operated with horse power, but electric systems will be at once inaugurated.

At the regular meeting of the New England Street Railway Company, held in New Haven, Ct., recently it was decided to pass the regular quarterly dividend of three-quarters of one per cent and devote the dividend, amounting to about $5,500, to the debt of the company. The New England Street Railway debt is $148,000, which was a loan of Boston banks made about a year ago, when the company took up its share of the Winchester avenue stock issue. The new Fair Haven road officers of the New England Company say that no dividends will be made by the company until the debt is raised.

Announcement has been made of the sale of the Amsterdam Street Railroad to the Fonda, Johnstown & Gloversville Railroad Company. The price is said to be in the neighborhood of $175,000. It is expected that the line will, in due time, be extended across the country, connecting with Johnstown and Gloversville. Last week new directors were chosen for the Amsterdam road, consisting principally of New York lawyers. The Amsterdam road was established in 1873 by Amsterdam capitalists, but of late has been controlled by New York parties. In 1890 the road was equipped with electricity. John S. Wise, of New York, was president of the company.

One of the most important deals in trolley lines that has taken place in northern New Jersey this year was consummated recently in the sale of United States Senator John Kean's company, which operates the street railway between Elizabethport and Elmora, and is planning to extend to Cranford, to the Riker-Hine syndicate, which operates the Plainfield Street Railway Company, the Westfield & Elizabeth Street Railway Company and the Rahway Street Railway Company. This sale will put an end to the contest between Senator Kean and the Riker interests, which have been fighting each other for three years to secure advantageous routes for the rival lines between Plainfield and Elizabeth. The terms of the sale have not been made public. The Riker-Hine syndicate now controls nearly 60 miles of trolley tracks in Union and Middlesex counties.

The Schuylkill Traction Company's lease of the Lakeside Railway, and the building of a connecting link between Ashland and Centralia, Pa., which was put into operation a few days ago, is but the furtherance of a gigantic electric railway scheme. The Pottsville Union Traction Company is about taking up a plan to reach Frackville, and will also build a branch to Middleport this Fall. That will be followed by a connecting link to Tamaqua, which will connect with the electric railway running from Tamaqua to Summit Hill. A trolley road is to be built from Westwoods through Tremont to connect with the system operating at Tower City, Williamstown and Lykens. This will be one of the most extensive trolley railway systems in the country. Over 150 miles of electric railway track will be connected, and the system will represent an investment of between $3,000,000 and $4,000,000.

The North Jersey Street Railway Company is about to build another trolley line from the Oranges to Newark, N. J., that will open up a section that is now without easy access to Newark. The new line is to be in continuation of the South End Road, in Montclair, which runs from Montclair Centre, along Orange Road, to its terminus at the East Orange line. The route will be from Orange Road along North Park street to Springdale avenue, and easterly along Springdale avenue to or near the Newark line. Mr. David Young, the general manager of the North Jersey system, says that he hoped to get permission from the Essex County Park Commission to cross Branch Brook Park, in which case the new line would run directly down either Third or Fourth avenue to Bloomfield avenue. If this plan is not feasible then the road will run in Springdale avenue to the Ampere station of the Lackawanna Road, and thence southerly through one or more streets to a connection with the present Orange Line, at the Roseville car barns.

The New England Engineering Company, of Waterbury, Ct., has opened offices in the American Surety Building, 100 Broadway, New York city. These increased facilities have been made necessary by the growth of the business of this widely-known engineering company. Its work in the line of building and remodeling electric railways and electric light and gas plants has given it a reputation second to none in the field. The new offices are located on the seventh floor of the American Surety Building, and are in charge of Mr. A. O. Shepardson, treasurer of the company, and staff of engineers.

TELEPHONE AND TELEGRAPH

The new telephone line connecting Oak Harbor, Genoa, Clay Center, Elmore, Rock Ridge and other towns in Ottawa County, Ohio, is being constructed.

The Citizens' Telephone Company, of Grand Rapids, Mich., has decided to put a new line from Hastings to Lake Odessa by way of Coats Grove and Woodland.

The stockholders of the New York Telephone Company will hold a special meeting, in New York, on August 8 for the purpose of voting on a proposition to increase the capital stock from $16,000,000 to $30,000,000.

The members of the Home Telephone Company held a meeting in Cleveland lately and decided to begin work on the Findlay, Ohio, plant in a short time and push it forward vigorously. The work will give employment to a great many men, and thousands of dollars will be paid out in wages before the snow flies.

The City and Suburban Telegraph Association, of Cincinnati, Ohio, has issued Bell telephone directory No. 38, which, as usual, is conveniently arranged with a marginal alphabetical index. This issue of the directory marks a change in the system of call numbers, and the service also includes automatic signal telephones and magneto signal telephones.

Although negotiations have not yet become tangible, it is understood that a connecting current exists between the new National Telephone and Telegraph Company and the Western Union Telegraph Company, and that if a project, which at present is only tentative, can be carried to the point of a definite deal, there will be formed a powerful consolidation of telephone and telegraph interests.

The charter of the National Telephone and Telegraph Company, the successor to the Telephone, Telegraph and Cable Company of America, gives the directors authority to issue bonds without consent of stockholders, and to apply surplus earnings to the purchase of property and of its own capital stock on bonds. Neither the property nor the stock and bonds shall be regarded as profits for the purpose of dividends unless so determined by a majority of the directors. The directors can make and alter by-laws.

The Wisconsin Telephone Company will break ground this year upon the new $60,000 exchange which it will build on Fifth street, between Grand avenue and Wells street, in Milwaukee. General Manager J. D. McLeod said recently that work was in progress upon the plans for the equipment of the station, which is ultimately to answer the needs of 6,000 subscribers, but that they would not be in readiness for some time. The new building is to be the general headquarters for the company in Wisconsin, the building on Broadway being too small.

The Chicago *Economist* says that $500,000 Central Union Telephone consolidated mortgage five per cent bonds will be issued this Summer, and an additional $500,000 will be put out next Fall. This $1,000,000 will cover the construction work for the year, as compared with $1,913,465 spent in construction last year. The consolidated mortgage provides for a total issue of $6,000,000, of which $2,500,000 were reserved to retire the first mortgage 6's and $2,000,000 were issued up to December 31, last. After the proposed $1,000,000 issue of 1900, there will, therefore, remain $500,000 for further extensions. Up to July 1 the company added about 6,000 subscribers, and it is probable that by the end of the year the total number of subscribers will have risen to 75,000, or more than double the number at the end of 1897. There is still a good deal of competition and rate-cutting by independent companies.

The Cuyahoga Telephone Company, of Cleveland, Ohio, will spend the sum of $1,000,000 in enlarging its facilities. Already the capital stock of this independent company is $3,000,000. Improvements under contemplation will necessitate the increasing of the stock another million. It is the intention of the stockholders of the company to more than double the present capacity. The present switchboard will be increased to twice its size. In addition three branch exchanges will be constructed. When the contemplated improvements are completed the company will be able to handle 20,000 individual subscribers. The Cuyahoga plant will then be the largest independent exchange in the world. When the company was originally organized it was the intention to operate "party line" telephones and the switchboard purchased, which is one of the largest in the world, was capable of operating about 20,000 telephones, figuring on "party line" business. When the company decided not to operate four or five telephones on one line it was found the present switchboard was not equal to the immediate prospective business of the company. It was concluded by the stockholders that while increasing the facilities of the company, it would be well to enlarge the switchboard. The new switchboard has already been ordered and it is expected it will be installed and ready for operation this Fall. The company is preparing to erect three branch exchanges. One exchange will be located in East Cleveland, another in Nottingham and the third at Rocky River.

Mr. Charles J. Glidden, president of the Erie telephone system, operating telephone companies aggregating capital having par value $25,000,000 and a market value of $33,000,000, organized his first stock company at Manchester, N. H., at the age of 18, in the year 1875. The following is a copy of the original subscription:

October, 1875.

WHEREAS, it has been considered advisable to build a telegraph line from Manchester to Goffstown, West Village (via Goffstown Centre), and the undersigned agree to take the amount of stock subscribed to their respective names, providing the whole amount for building the line, supplying instruments and other necessary apparatus, and connecting the same with the Atlantic & Pacific Telegraph Company's line in Manchester, does not exceed the sum of Eight Hundred Dollars ($800).

All persons subscribing shall become shareholders, and the line to be owned and conducted by them only.

The line shall be erected under the charter of the Northern Company, but in every other respect to have a separate existence; when built it shall be operated by the Atlantic & Pacific Company, which company has now a lease of the Franklin Company, which holds a lease of the aforesaid Northern Company, and has facilities for transmitting messages all over the United States, Canada, and by cable to all parts of Europe.

The tariff for transmission of messages both by the shareholders and general public to be hereafter determined, and as often as shall be deemed necessary the earnings of the line—after deducting working expenses—shall be divided pro rata between the shareholders, as in all other corporations.

The only expenses attendant upon the working of the line will be a percentage paid to the operator at Goffstown, West Village, as the Atlantic & Pacific Company have agreed to run and keep the wires in good repair, charge batteries, etc., free of charge.

The stock to be divided into 80 shares, at Ten Dollars ($10) per share.

NAME.	NUMBER OF SHARES.
P. C. Cheney	5
D. M. Taggart	3
Kendall, Hadley & Company	10
G. N. Johnson	2
Dr. Newell	5
Ziba Hoyt	3
Junkins & Company	2
J. M. & D. A. Parker	10
A. Richards	3
J. Carlton	2
J. Brugger	15
C. J. Glidden	5
E. M. Bryant	2
Arthur Haseltine	2
Charles A. Whipple	5
A. C. Wallace	5
P. J. O'Neil	2
Dr. Tubbs	4
	80

The Company was formally organized as the New Hampshire Telegraph Company, and paid dividends at the rate of 25 per cent annually for a great many years. The line is now operated as a private telephone line.

Exhibition by the Automobile Club of America.

Secretary Homer W. Hedge, of the Automobile Club of America, of New York city, has sent to the members of the club the following circular letter:

The board of governors direct that notice be given of the exhibition of automobiles and accessories, which will be held at Madison Square Garden, from November 3 to 10, 1900, under the auspices of the Automobile Club of America.

The club committee on this exhibition announces that all the floor space of the Garden has been rented by intending exhibitors, and it is proposed to utilize some additional space by flooring over the boxes, for the exhibition of accessories.

One of the features of the exhibition will be a circular track, on which automobiles of all kinds will be shown in motion, and it is proposed to utilize this track for the purpose of contests of various kinds, under the direction of the technical committee of the club, in the several classes of automobiles exhibited. The following gentlemen compose the exhibition committee: A. R. Shattuck, chairman, 11 Broadway; General George Moore Smith and E. E. Schwarzkopf. Communications or inquiries should be addressed to the chairman of the committee.

Roentgen Society of the United States.

The Rœntgen Society, of the United States, will meet in New York city, December 13 and 14, 1900, at the Academy of Medicine. Papers have been promised by eminent men abroad and in the United States, and a very successful scientific meeting is apparently assured.

There will be offered advantages to the visiting members for instruction in X-ray work that can not be had under any other conditions. It is especially desired that all hospitals using X-ray apparatus, X-ray studios, physicians, surgeons and dentists doing X-ray work, scientific investigators, manufacturers and dealers in X-ray apparatus of all kinds throughout the United States should at once send their names and addresses to the chairman of the committee on arrangements, Dr. S. H. Monell, 43 East Forty-second street, New York city, N. Y., so that they may be sent important notices regarding the meeting. This society is the only one of its kind in America, national in character and for scientific purposes only.

A number of experiments will soon be made by the German army with different types of automobiles for military service. The railway brigade has charge of the matter, and are to make a series of trials in the open country, in the neighborhood of Eberswalde a small town about 25 miles from Berlin.

Hewitt-Lindstrom Electromobiles.

In the issue of the ELECTRICAL REVIEW for July 18 there was described a number of types of the electromobiles manufactured by the Hewitt-Lindstrom Motor Company, of Chicago. The two vehicles herewith illustrated are examples of the recent construction work of the same company, and well typify the general principles of design peculiar to its product. In Fig. 1, which represents a break seating four persons, the peculiar arrangement of reaches running fore and aft of the vehicle and designed to give it a flexible wheel base, is clearly shown. This break carries two single-reduction-gear motors, which are swung from the rear axle and cushioned on the reaches, as fully described in the former article. As is usual in such vehicles, it is operated from the left-hand side of the front seat, the steering handle being convenient to the right hand of the driver and the controller to his left hand. The vehicle is a very symmetrical design, as may be seen from the illustration.

FIG. 2.—HEWITT-LINDSTROM ELECTRIC DELIVERY WAGON.

Fig. 2 shows an electric delivery wagon, made by the same company, which has a capacity of 45 miles on level roads on a single charge. It is claimed that it will take a 20 per cent grade, and that it will carry a load of 1,500 pounds. The total weight of the vehicle is 2,825 pounds; that of the break shown in Fig. 1 is 2,500 pounds, and this vehicle will travel about 40 miles on a charge, carrying four people. Both of these types of electromobiles represent a high class of construction, and, as may be judged from the illustrations, are elaborately finished and complete in all accessory details.

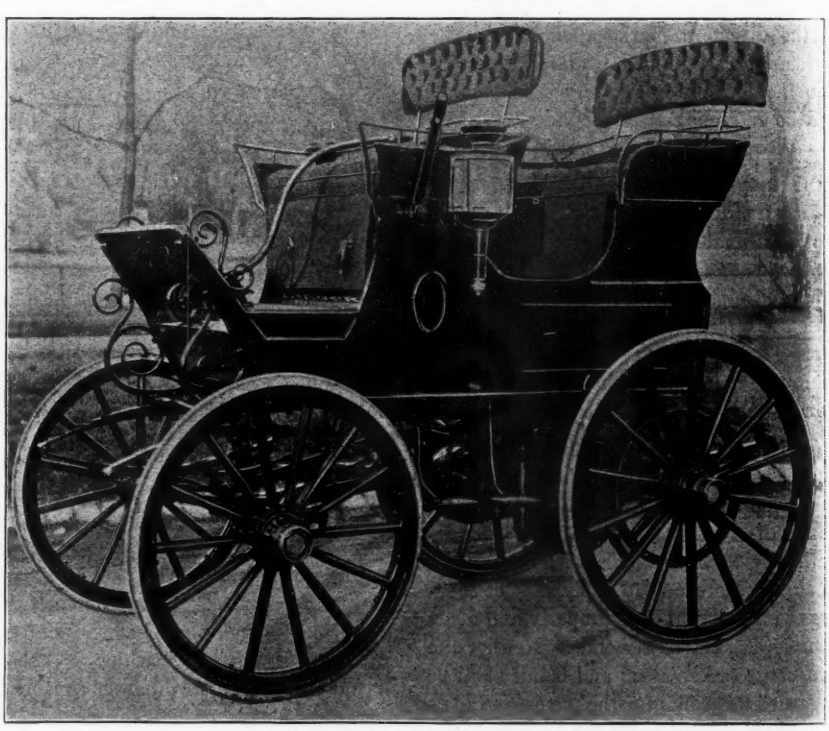


FIG. 1.—HEWITT-LINDSTROM ELECTROMOBILE BREAK.

AUTOMOBILE NOTES.

The Hotel Raleigh, at Washington, D. C., has established an electromobile cab service, the vehicles being supplied by the Washington Electric Vehicle Transportation Company.

The Baltimore & Ohio Railroad, whose cab service in Washington, D. C., was recently described in the ELECTRICAL REVIEW, has established a similar service in Philadelphia.

William K. Vanderbilt, Jr., was arrested in Milton, Mass., on July 20, for running an automobile at a faster rate than the law allowed. After depositing the necessary amount for his appearance in court, he left, on his automobile, for Newport, R. I.

The Paris Exposition Exhibit of the Standard Paint Company.

Among the most novel of the American exhibits at the Paris Exposition is a pavilion erected by the Standard Paint Company, of New York. It is unique in construction and in its location, at the Avenue d'Iena entrance. The inscription "Standard Paint Company," the American and European trade marks and the locations of the various head offices—New York, London, Paris, Hamburg, Berlin and Sydney—appear on the front of the pavilion; while, surmounting the roof as a weather vane, is the well-known "P & B," with the rooster trade mark in gold. The trade mark seems peculiarly fitting in a place so entirely Gallic in character, as the building itself is occupied by the officers of the Paris customs, which is indictated by the legend "Poste d'Octroli."

THE STANDARD PAINT COMPANY'S PAVILION AT PARIS EXPOSITION 1900
CONSTRUCTION EXTERIOR AND INTERIOR DECORATED RUBEROID

A Handsome American Exhibit at the Paris Exposition.

By special concession, after the French architects had themselves made successful use of P & B "Ruberoid" in the hallways and on the stairways of the chief operating building of the exposition commissioners, at No. 2 Avenue Rapp, for more than a year before the exposition opened, it was arranged that an ornamental pavilion, to be constructed inside and out, flooring, sides, ceiling and roof, of ruberoid, should be erected for the use of the French authorities in the colonial section. Thus, a building purely American in material is being actually used during the term of the exposition by the French government. It is classified in the section of architecture.

Ruberoid, which has been so largely used as roofing all over the United States, in nearly every European country, in Australia, Africa, and parts of Asia, is shown in the Paris pavilion capable of the highest decoration.

The ruberoid covering the exterior walls is decorated in imitation of gray birch with pilasters in oak. The roof is ruberoid undecorated. The interior walls, above the base of imitation wood, are tastefully painted in floral designs on a delicate background as in fresco. The ceiling is panelled and the ruberoid elaborately decorated in allegorical design, emblematic of the American, European, Asiatic and African continents. The flooring bears a tastefully colored border in Grecian design. Though ruberoid was in service as a decorated flooring at the recent Brussels, Sydney and other expositions, the Paris decorations are of a more artistic grade than has heretofore been attempted; and, as floors covered with ruberoid have shown a lasting quality of over five years, here would seem to be a material that will before long prove a formidable rival to oil and other floor cloths, having the further merit of being below such in cost.

The roofs of the exposition warehouses in the Rue Javelle are also covered with ruberoid, and thus this American product has on its special merits won the highest place, where the barriers of tariffs, natural trade prejudices and the world's competition were all encountered.

In the American section (machinery and electricity department) the P & B electrical compounds, insulating varnish and tape are shown; in the civil engineering and transportation department are the well known P & B insulating papers, roofing and other products of the Standard Paint Company. The reproduced photograph shown on this page gives a very clear idea of the pavilion which typifies a material, the use of which in the past 10 years has spread from its native New York and New Jersey to the De Beers Mines, South Africa, to the German settlement at Kiautchau, China, and every portion of the civilized earth.

The chief offices of the company in Europe are at 50 Boulevard Haussemann, Paris; 59 City Road, London, E. C.; both of these offices being in charge of Robert W. Blackwell & Company, Ltd.; at 16 Friederich strasse, Berlin, and 33 Grimm, Hamburg, the German offices being in charge of Allut Noodt & Meyer Company, Ltd.

American visitors to the exposition will be heartily welcome at these offices, and every possible courtesy will be extended to them.

LITERATURE

"A Prisoner Among Filipinos" is the title of Lieutenant-Commander James C. Gillmore's account of his extraordinary experiences in the Philippines, which begins in the August *McClure's*. Lieutenant Gillmore was captured by savage tribes while out in a small boat with a scouting party on the east coast of Luzon. He had more than one narrow escape from death. For several months these men traveled hundreds of miles through the heart of Luzon, enduring unspeakable hardships, with no prospect of escape from an awful fate at the hands of bloodthirsty Tagals. The illustrations by W. R. Leigh, after the author's own sketches, are marvelously graphic.

PERSONAL.

Mr. A. C. White, general manager of the Providence Telephone Company, sailed last Wednesday on the Friesland for a tour of Europe, where he goes for rest and pleasure. Mr. White will visit the Paris Exposition, and various of the European capitals during his stay abroad.

Third Rail System in Brooklyn, N. Y.

The Brooklyn Rapid Transit Company has completed the third-rail system on the Kings County Elevated Railroad, and electricity will be used in operating the trains within the next 10 days.

VIEWS, NEWS AND INTERVIEWS

A novelty in outdoor advertising may be observed on the trolley road which runs between Washington, D. C., and Mount Vernon. In several places along the road the ordinary bill posters' signs may be seen, but many of them are equipped with a reflector containing incandescent lamps placed at the top of the sign. An overhead line taps the trolley feeder and supplies current to the lamps, which, at night, throw their beams down upon the sign and illuminate it for the benefit of the trolley passengers. This is a unique idea, and, consistently carried out, should prove to be effective.

At the Army and Navy Club, in Washington, D. C., there is a little box of an elevator which carries members from the entrance hall to the upper floors. Just alongside the elevator door is a telephone booth. A few evenings ago two members arrived at the club house a little the worse for wear. They sat down in the telephone booth, conversed confidentially for a few minutes, much to the enjoyment of fellow-members standing near, and then demanded vociferously why the boy did not start the elevator. After their friends had amused themselves sufficiently, they were informed of their error and placed in the proper compartment.

An interesting experiment in photography by electric light has recently been conducted by a well-known New York photographer. In attempting to take portraits by electric light, heretofore it has been usual to employ arc lights, which generally have the effect of half blinding the sitter, causing a pained expression about the eyes, while the distribution of light can not be so good as if the sources were more numerous and scattered than in the case of the usual arcs and reflectors employed. The new method employs incandescent lamps which are attached to an umbrella-shaped contrivance placed over the head of the sitter. This carries 22 lamps, of which 21 are of 100 candle-power each and the other, at the centre, of 150 candle-power. The umbrella is covered with white silk tending to make a diffused radiation of the light. A few of the lamps are used in focusing and when all is ready all are turned on, the voltage employed being about double that for which the lamps are rated. Under these circumstances the lamps burn with intense brilliance, giving a soft, pure, white light aggregating about 5,000 candle-power for the whole device. With exposures from two to three seconds admirable photographs have been taken, showing good detail and the soft and diffused illumination which is such a desideratum in portrait photography.

Mr. H. R. Bostwick, a civil engineer of San Francisco, has just closed a contract with the government of Corea to build an imperial highway, 15 miles long, and an extension of the Corean electric railway on one side of it, says a press despatch. The contract calls for $1,000,000, and this large sum spent by Corea is the reason, the imperial astrologers declare, why the spirit of the young queen, who was murdered several years ago, could not rest peacefully in the present cemetery. This cemetery is five miles from the king's palace, in Seoul, and to reach it speedily on the frequent pilgrimages required, the king conceived the idea of building the trolley line. Mr. Bostwick constructed it, and it was opened a year ago. Soon the king decided it would pay to open the road for general use. So, to accustom the people to the foreign means of travel, all were allowed to ride free for one week. The experiment was disastrous, as a little girl, bidden by her father to cross the track in front of an approaching train, was killed. A mob tried to kill Mr. Bostwick and to wreck the road. When quiet was restored motormen were imported from San Francisco, and the road ran once more as usual. Then the king, after holding out one whole year against the astrologers, decided to move the queen's body. But to do this he concluded to move the whole cemetery 15 miles inland to a place the astrologers declared was propitious. Hence the contract with Mr. Bostwick and the big expenditure for the little kingdom. The tombs were very elaborate, and many of the sepulchres are of colossal size, so that the undertaking is large and costly.

Electrical Progress in Australia.

Mr. S. W. Childs has just returned from Australia, where, for the past 18 months, he has been engaged in the construction of an extensive electric tramway system for a London syndicate. In handling this important work, Mr. Childs has made his usual record in overcoming the many difficulties of material and labor which presented themselves. Mr. Childs traveled all over the Australian colonies and reports that extensive projected installations are being carried out. He further says that in nearly every instance American equipments have the call as well as American methods, both of which are giving entire satisfaction.

Wall Street and the Electrical Stock Market.

The Chinese situation occupies the foremost position in financial interest at the present time. The advices received regarding developments in China are of dubious authenticity and the situation is extremely vague and unsettled. The possibilities involved in the question give it the first place in financial attention. The effect for the current week of the Chinese question upon the world's market has been rather a repressive than a depressing one. The market closed the week with a general advance and dealings in fair volumes for a mid-summer half-holiday.

On the New York Stock Exchange, General Electric closed the week at 130 bid and 130¼ asked, a loss of 1¾ points for the week. Metropolitan Street Railway, of New York, closed at 154¼ bid and 154½ asked, a gain of 3½ points for the week. Third Avenue Railroad closed at 111 bid and 112 asked, a gain of 1 point for the week. Brooklyn Rapid Transit closed at 56¼ bid and 56½ asked, a gain of 3⅛ points for the week. Manhattan Railway, of New York, closed at 90½ bid and 90⅝ asked, a gain of 2⅝ points for the week.

On the Boston exchange, American Telephone was not quoted. Erie Telephone closed at 96 bid and 98 asked, a loss of 2 points for the week. New England Telephone closed at 123 bid and 125 asked.

On the Philadelphia exchange, Electric Storage Battery closed at no bid price and 70 asked. Union Traction closed at 37⅜ bid and 37⅝ asked, a gain of ⅛ point for the week. Electric Company of America closed at 9⅜ bid (ex dividend) and 9½ asked, a loss of ⅜ point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 22½ bid and 24 asked, a gain of 1 point for the week. Electric Boat closed at 16 bid and 18 asked, indicating no change for the week.

Wall street, July 21.

Another Murderer Electrocuted at Sing Sing.

The electrocution of Joseph Mullin, a wife murderer, in Sing Sing, N. Y., prison, at six o'clock, A. M., on July 23, was the most successful of any of the 34 executions that have occurred in that prison. It took only one shock to produce death, and the voltage of 1,700 alternating was maintained for only one minute. There have been cases in which five distinct shocks were necessary to produce death.

A Consolidation of Two Western Electrical Houses.

The Miller-Knoblock Company, South Bend, Ind., manufacturers of commutators and armature coils, have consolidated with the Northwestern Electric Manufacturing Company, of Chicago, makers of magnet wire, electromagnets and spark coils, and the combined business will be conducted under the name of the Miller-Knoblock Electric Manufacturing Company, at South Bend, Ind.

The machinery composing the covering plant of the Northwestern Company has been moved to South Bend and set up, and is now in operation.

The Miller-Knoblock Electric Manufacturing Company will immediately build additional insulating machines, and, while the plant they are now operating produces silk and cotton-covered magnet wire from No. 18 to No. 40, the new machines will increase the line from No. 0 to No. 40.

With increased capitalization the company contemplates large improvements, not only in the commutator and armature coil business, but in the magnet wire business, and, as the plant occupied is large and well adapted to the work, the product should be equal to any on the market, and as South Bend is an ideal point for manufacturing and selling, there is every prospect that the company's business will continue to increase.

The company will make a specialty of fine covered wire and coils for telephones.

The city council of Alliance, Ohio, has determined to erect a municipal electric light plant.

New German Process of Welding Pipes.

At the congress of the Saxon associations of engineers and architects just held at Liepzig, Mr. Max Schiemann, of Dresden, delivered a lecture, accompanied by experiments, on the "Goldschmidt process for obtaining high temperatures and its practical application," writes United States Consul Richard Guenther, from Frankfort. He compared this new process with those hitherto used for heating metals for welding. He showed by experiments the new method of welding cast-iron gas pipes of two to four inches in diameter, and demonstrated the very simple application of the process and its result. Briefly stated, it consists in mixing powdered aluminum with oxide of iron and adding to it an easily ignitable substance. This powder is put into a clay crucible and then ignited by means of a match. The resulting chemical action renders the mixture liquid, and this liquid is then poured around the place to be welded. The object assumes a white heat and the welding is done by a very simple apparatus. The welded places show the same firmness as the original piece, and manifold application of the method is possible. In the near future, it is proposed to weld the rails of the electric tramway at Dresden, which has already been done in other places. The speaker welded rails before the audience, and the experiments were pronounced very successful, especially on account of the simplicity of the process. It is considered a very important discovery, and great hopes are entertained for it.

Automatic Electric Arc Lamp Support.

The increasing number of fatalities attending the trimming of arc lamps has led to the design of the ingenious automatic support shown in the accompanying illustrations. The object of the support arrangement is to facilitate trimming, at the same time removing the danger incident to handling lamps on a circuit which may be alive. It is clearly shown in the accompanying illustrations. The method upon which it works is that when the lamp is lowered it is removed from circuit; when the lamp is in the lowered position it is supported by a sprocket chain, as is well shown in Fig. 1. When this chain is wound up, the lamp-carrying part of the device is securely latched into the upper portion, completing the electrical contacts. An upward movement of the chain for a short distance releases the latches and permits the lamp to be swung down; at the same time the connections with it are severed and the lamp can be handled with perfect impunity. The apparatus is constructed with reference to its use both indoors and out, a form of lamp-suspending post for outdoor work being illustrated in Fig. 4. It is claimed that a great saving of time as well as elimination of danger is secured by this device, which is made by Mr. Harry Long, Greentown, Ind., under a number of patents secured by him. All of the parts are insulated with mica and are made interchangeable, so that they may be readily replaced.

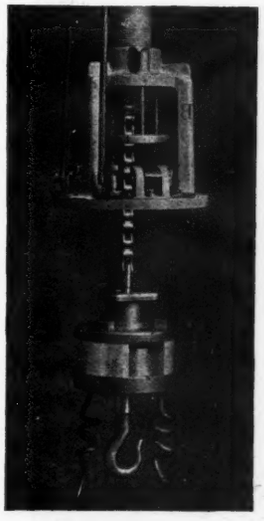
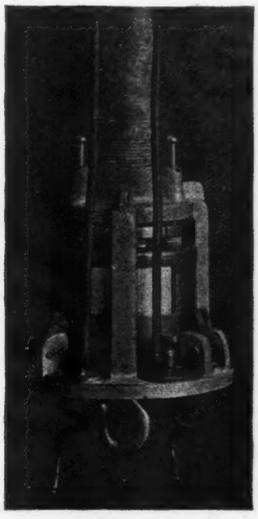
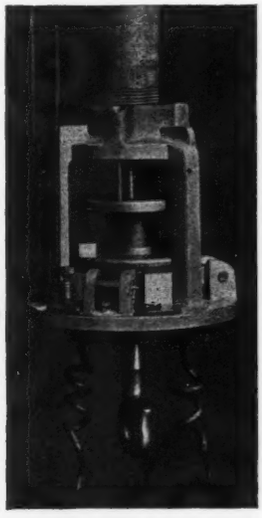


FIG. 1.—AUTOMATIC ARC LAMP SUPPORT, LOWERED.





FIGS. 2 AND 3.—AUTOMATIC ARC LAMP SUPPORT, CLOSED—SIDE AND FRONT VIEWS.

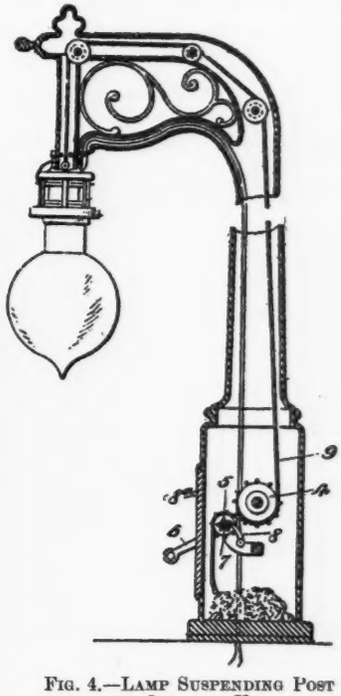


FIG. 4.—LAMP SUSPENDING POST FOR OUTDOOR USE.

Storage Batteries in a Print-Cloth Mill.

The Arnold Print Works, which are situated at North Adams, Mass., cover a very large area, having reached their present size by a steady growth and addition of buildings. As a result of the growth the demand for light and power is scattered over a large area and generators have been installed in various parts of the works to meet this demand upon them. The installation illustrated here is one of chloride accumulators which have been put in to steady the operation of the largest of the various plants. The battery consists of 60 cells in glass jars, and is worked in connection with the plant consisting of a four-pole, 125-volt, 60-kilowatt, compound-wound generator driven from a line shaft connected with a 250-horse-power Harris-Corliss engine.

This generator has connected with it 300 incandescent lights and 40 arc lights, also motors of the following capacities: Three 10 horse-power and one 7½ horse-power, for elevator service, and one 15 horse-power, for filtering machines.

This service is largely intermittent, and it was found that the fluctuations produced by the starting up of loaded elevators were sufficient to overload the generator seriously, and, at the same time, to cause the speed of the engine to drop, thus causing the machinery to operate irregularly and the lights to flicker badly. Moreover, the entire lighting load on some days is too heavy for the generator alone.

The conditions under which the battery is operated make this situation one of unusual interest, owing to the varying requirements. The battery is used sometimes as a regulator to eliminate the fluctuations from the generator load, allowing the latter to operate at a steady load. It is used for peak work during certain times of the year when the lighting load becomes very heavy, and for all-night lighting when it is desired to operate the napping room at night.

To accomplish these various results, two separate sets of bus-bars are provided. The generator and lights connect to one set through double-pole, single-throw switches. The motors are all connected to the other set of bus-bars through double-pole, single-throw switches. When it is desired to use the battery as a regulator it is thrown into connection with the power bus-bars. The positive bus-bars of both systems are then connected by a switch and the negative bus-bars are connected together through the booster.

The booster, when connected up in this way, is what is called a constant-current booster, and is designed to keep the flow of current from lighting-bus to power-bus practically constant, and equal in amount to the average load taken by the motor circuit. The booster is a small, specially-wound generator, driven by a motor, with an armature capacity equal to the average motor load. So close is the regulation thus effected that a load equal to the maximum rate of the battery, or 160 amperes, thrown suddenly on the power bus-bar does not increase the output of the generator sufficiently to cause any perceptible variation in the voltage of the lighting bus-bars, nearly the entire fluctuation being taken by the battery.

Should it be desirable to operate the entire system from the battery alone, a case which would occur if the generator belt should happen to break unexpectedly, it may be done by connecting the power and lighting bus-bars, the booster being then cut out.

When the battery has been nearly exhausted by an all-night run and it is desirable to charge it up, it can be connected to the bus-bars through an underload switch and through the booster, with the series coil cut out. The booster excitation is now controlled only by its shunt field and may be set to add any desired voltage to the bus-bar voltage in order to charge the battery steadily.

At certain seasons when the factory is crowded with work it becomes necessary to operate the napping-room all night. This only requires four or five horse-power, but previous to the installation of the battery it was necessary to operate the engine with a dead friction load of about 30 horse-power, and also to maintain an attendant at a cost of two dollars a night. This is now all saved by throwing the lighting load on the battery at night. As the battery voltage drops from its discharge, the watchman, on his regular rounds, cuts in end cells.

The battery-room is well shown in the illustration. Each cell stands on a tray filled with sand, this in turn being supported on glass insulators. All the attendance that the battery-room requires is adding about an inch of evaporated water to each cell every week.

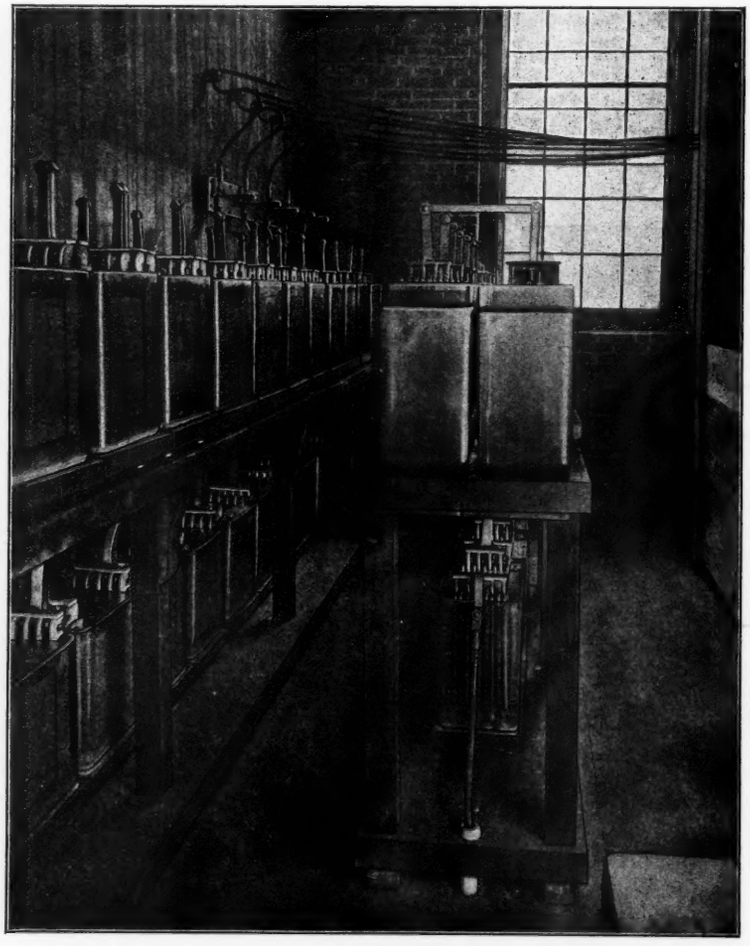


Fig. 1.—The Battery Room at the Arnold Print Works.

BOOK REVIEWS

"Photometrical Measurements and Manual for the General Practice of Photometry." By Wilbur M. Stine, New York, 1900. Macmillan Company. Cloth. Five by seven and one-half inches. 270 pages, 67 illustrations. Supplied by the ELECTRICAL REVIEW at $1.60

Photometry is a subject about which much is said and very little understood. Professor Stine has done an excellent work in producing this complete and careful treatise on the subject. The subject of photometry is one that has been little understood in the past and which needs to be earnestly studied in the future. In this manual either the student or the practitioner desiring to work with the photometer and make tests can find the information that he desires.

"Modern Electric Railway Motors. A discussion of current practice in electric railway motor construction, maintenance and repair." By George T. Hanchett, New York, 1900. Street Railway Publishing Company. Six by nine inches. Cloth. 200 pages, 157 illustrations. Supplied by the ELECTRICAL REVIEW at $2.00.

Mr. Hanchett is an exceedingly practical man, and, as a consequence, he has written an exceedingly practical book, which tells, in the fewest possible words and with the least complexity, what the inquiring reader wishes to know. The book is not written so much for those entirely familiar with the electric railway field as it is for those who are about to enter active work in it and wish to learn something about it. To quote the author's preface: "The object of the book, in short, is to show how electric railway motors are made to-day, and why they are made so." The book is not obscured in any way with mathematics. There is a chapter at the end on the design of street railway motors. but, even in this, formulæ have been kept in the background and plain numerical examples used. The various chapters take up the details of construction and end with a resumé of data and dimensions and a short thesis on the management and repair of street car apparatus. The book is a neat and substantial volume and one that is destined to meet the demand for a book that is both practical and simple, and, at the same time, full and accurate.

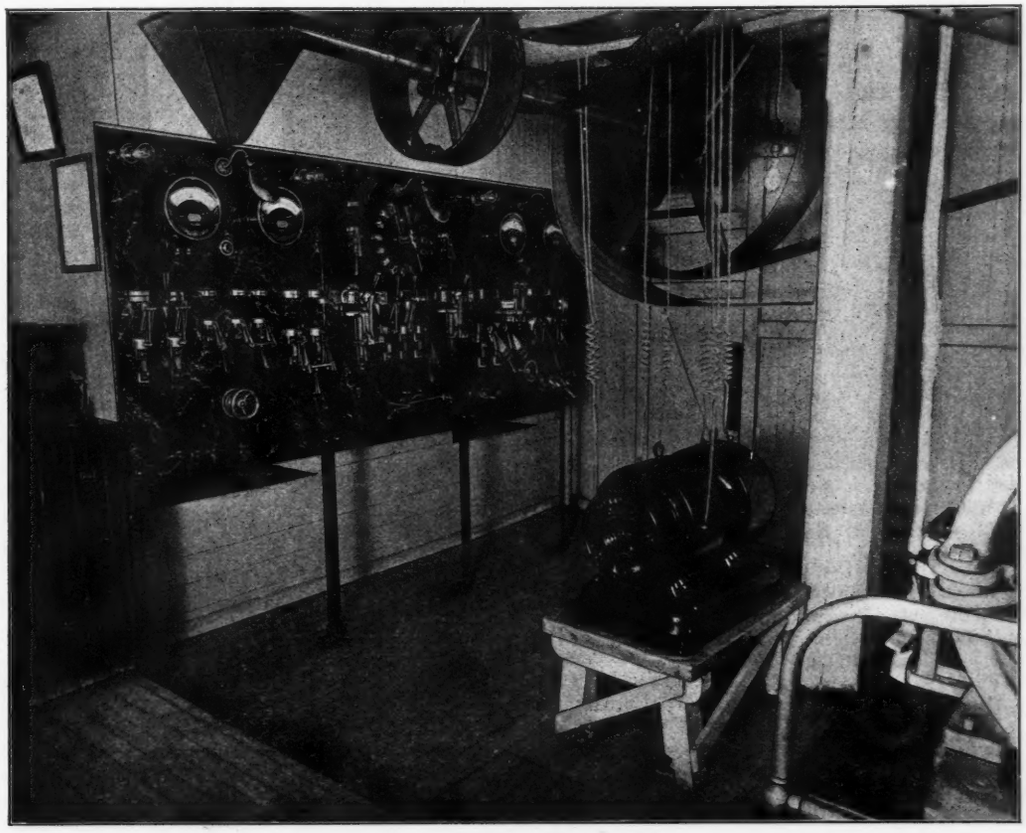


FIG. 2.—SWITCHBOARD AND BOOSTER FOR THE STORAGE BATTERY INSTALLATION AT THE ARNOLD PRINT WORKS.

OBITUARY.

WALTER TENNEY CARLETON.

The death of Walter Tenney Carleton, for the past three years the Western Electric Company's representative in Japan, occurred at Haverhill, Mass., on July 6, 1900.

His health for a year past had not been good, but on his return to this country in June he had expected that he would be able, after a brief vacation, to take up the work that had been assigned to him at the Chicago house. His death occurred after three days' illness from peritonitis, following an unusually difficult operation for appendicitis.

Mr. Carlton was 32 years of age and had been in the company's service over eight years. He was graduated from Dartmouth College in 1891 and began work with the company at New York in the following Spring. Most of his work there had been in connection with the telephone sales and he had a large acquaintance among telephone men in the East. In 1897 he went to Japan to look after the company's interests there, and he took a leading part in the organization of the Nippon Electric Company, of Tokyo, being its first secretary. He was devoted to the company's interests and his work was always efficient and successful. A widow and infant son survive him.

ALEXANDER R. PIKE.

Mr. Alexander R. Pike, manager of the San Francisco office of the Columbia Incandescent Lamp Company and the Wagner Electric Manufacturing Company, died very suddenly Saturday, July 14, in San Francisco, at the age of 29 years.

Mr. Pike was born in Brookline, Mass.; he attended the Massachusetts Institute of Technology, and entered the electrical field in 1890. He was superintendent of the testing department of the Missouri Edison Company until the Fall of 1896, when he resigned to enter the commercial side of the electrical business. He was very widely known among the electrical fraternity, and was a man of sterling quality and ability, and a host of friends will mourn his demise.

CORPORATION NEWS

DUNKIRK, IND.—The City Light and Power Company, of Dunkirk, has been incorporated. Capital stock, $8,000; directors: John H. Brown, K. A. Tracy and M. J. Cook.

EAST ORANGE, N. J.—The Automatic Telephone Meter Company, of East Orange, has been incorporated. Capital, $125,000; incorporators: C. Bate, W. Fairchild, E. J. McNulty.

CUERO, TEX.—The Cuero & Sasseville Telephone Company, of Cuero, has been chartered. Capital, $6,000; incorporators: Mrs. Jane Hunter, Mrs. Willie Breeden, Mrs. S. D. Weldon, all of Cuero.

NACOGDOCHES, TEX.—The Texas Gulf Telephone Company, of Nacogdoches, has been incorporated. Capital, $10,000; incorporators: E. C. Branch, George H. Davidson, K. K. Branch, W. S. Beeson, all of Nacogdoches.

GENEVA, IND.—The Geneva Telephone Company, of Geneva, has been chartered to operate telephone lines. Capital, $5,000; incorporators: H. M. Aspy, A. J. Miller, A. G. Briggs, T. Drew, O. O. Juday, all of Geneva.

HAGERSTOWN, IND.—The Hagerstown Telephone Company, Hagerstown, has been incorporated to operate a telephone line. Capital, $8,000; incorporators: J. Bowman, B. G. Jewett, J. M. Hartley, L. M. Pierce, all of Hagerstown.

CHICAGO, ILL.—The Economic Light and Power Company, of Chicago, has been incorporated to operate light, heat and power plants. Capital, $10,000; incorporators: E. C. Wetlen, D. T. Campbell, L. Spahn, all of Chicago.

CHICAGO, ILL.—The Scientific Manufacturing Company, of Chicago, capital $50,000, has been chartered for manufacturing electrical and scientific instruments and devices; incorporators: H. L. Peters, E. J. Farrell, C. R. Harris.

CAMDEN, N. J.—The American Universal Underground Electric Railway Company, of Camden, has been incorporated to operate trolley systems. Capital, $200,000; incorporators: W. Bartram, J. M. Deal, W. C. Alexander, C. P. Ballinger.

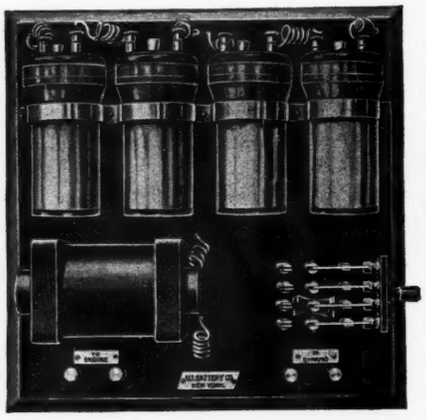
NEW ALBANY, IND.—The New Albany Street Railroad Company, New Albany, has been chartered to operate a street railroad. Capital, $30,000; incorporators: G. M. Clark, E. A. Hartmann, J. F. Newhouse, H. T. Meyer, J. H. Strack, all of New Albany.

PLAINFIELD, N. J.—The Plainfield Automobile Company, of Plainfield, has been chartered to deal in automobiles. Capital, $25,000; incorporators: G. W. Rockfellow, C. H. Hand, E. M. French, all of Plainfield; S. W. Drake, of Lincoln; C. A. March, attorney, Plainfield.

PITTSBURGH, PA.—The West Pennsylvania Long-Distance Telephone Company, of Pittsburgh, has been chartered to construct and operate a telephone line. Capital, $10,000; incorporators: H. A. Parr, S. N. Browne, both of Baltimore, Md.; W. D. Evans, R. A. Spring, W. W. Handy, all of Pittsburgh.

FLORENCE, COLO.—The Florence Electric Street Railway has been incorporated with a capital stock of $500,000. It will operate railroads in Fremont, Teller, El Paso, Pueblo and Custer counties, and will supply electric power for the general trade. The incorporators are: H. A. Cook, James Reed and Harry Robinson.

ZANESVILLE, OHIO—The Ben Franklin Electrical Company has been incorporated with a capital stock of $10,000. The incorporators are: Joseph Shaw, W. W. Harper, S. A. Weller, Willis Bailey, Guy C. Fergus and Robert B. Reed. The purpose of the company is the manufacture of a combined burglar alarm and home call clock, the patent for which has been secured by Messrs. Fergus and Reed.



A NEW IGNITION BATTERY.

IRONDALE, ALA.—Articles of incorporation have been filed by the Irondale Water, Light and Power Company. The capital of the corporation is $100,000. The purpose of this incorporation is to maintain and operate a system of water and gas works and electric light and power plant. The principal place of business is Irondale. The incorporators are: F. W. Turpin, N. H. Sewall and Robert R. Zeil.

NEW YORK CITY—The Seaside Electric Light, Heat and Power Company, whose operations are to be carried on in Queens County, has been incorporated with the Secretary of State. The capital stock is $5,000, consisting of shares of $50 each, and the directors for the first year are: William Wainwright, John Remsen, Mrs. Sarah Tater, William G. Wainwright and John W. Wainwright, of New York city.

PEEKSKILL, N. Y.—The certificate of incorporation of the Peekskill Lighting Company has been filed in the Westchester County Clerk's office. Its capital stock is $500,000, and the term of its existence 50 years. The directors are: Benjamin B. Nostrand, Jr., and Henry L. Armstrong, of Peekskill; H. Hobart Porter, Jr., Francis Blossom, Alfred Ely, Louise M. Fulton, Harold Binney, George H. Summerborn and Hillary C. Messimer, of this city; Richmond Talbot, of Tuxedo, and Henry S. Morton, of Hoboken, N. J.

HERVY CITY, ILL.—Secretary of State Rose has licensed the incorporation of the Hervy City & Southern Electric Railroad Company. The company plans the construction of an electric road from Hervy City to Shelbyville. The capital stock of the corporation is to be $150,000. The principal office of the road is to be located at Macon. The incorporators and members of the first board of directors are: J. Smith Butrum, Decatur; Robert B. Hennigh, Prairie Home; Robert H. Woodward, Harold Woodcock and John M. Turner, of Macon.

ANN ARBOR, MICH.—The Washtenaw Electric Company has filed articles of incorporation with the county clerk, placing its capital stock at $50,000. The purpose of the corporation is the producing of electricity and electric light. The offices are to be at Ann Arbor and Ypsilanti and the power plant at Geddes. Two thousand shares at $25 each are held by: Bernard Rorison, A. C. Rorison, W. J. Clarke, P. M. Miller, W. H. Sweet, C. L. Stevens, Robert Hemphill, Jr., A. Deyer, R. W. Hemphill, Clark Cornwell, H. P. Glover and R. W. Hemphill, Jr., trustee.

A New Ignition Battery.

There have been numerous inquiries for batteries to be used for the ignition of gas and gasolene engines. The United States Battery Company, of New York, has recently brought out a new battery, illustrated on this page, which is peculiarly well adapted for this work. The outfit consists of four of the No. 2 cells made by this company, put up in pairs, special spark coil and a double-throw four-point switch, all mounted together on a nicely-polished panel 16 inches square. Recharging is effected by means of a small generator to be driven by the engine itself, or from any other source of direct current available.

Two of these cells in series, using the special spark coil, will furnish spark for a single-cylinder engine making 280 revolutions per minute for upward of 100 hours on one charge, without missing an explosion.

The connections are so arranged that by throwing switch either to right or left, sparking begins from one pair of cells, and charging begins in the other. Polarity of current at spark points reverses each day, thereby causing points to wear equally. As these cells are run and charged on alternate days, they are never (barring accident to charging current) discharged beyond a fraction of their total capacity. This reduces the possibility of shutting down for repairs to a point hardly worth consideration.

Where it has been introduced the company has a uniform report of great increase in the efficiency of the engine.

ELECTRIC LIGHTING

Several local and out-of-town capitalists will, in the near future, organize a new electric light company in York, Pa. The new plant will be located in the eastern section of the city, along the line of the Pennsylvania Railroad. They propose capitalizing it at $100,000.

At the annual meeting of the Amesbury, Mass., Electric Light Company, the following board of directors was elected for the ensuing year: Dr. J. F. Spalding, Dr. J. A. Douglass, Ezra C. Morrill, John J. Mason, Dr. B. H. Young, George F. Bagley, Harrison Rowe; clerk and treasurer, Dr. B. H. Young.

The Norfolk, Va., Heat, Light and Power Company has arranged for an issue of $500,000 in bonds. Its property will be mortgaged to secure the Central Trust Company, of Philadelphia, which will underwrite the issue. The company will furnish electricity in competition with the Norfolk Railway and Light Company.

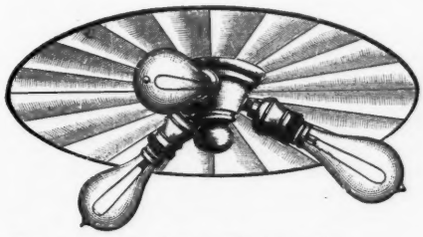


FIG. 1.—THREE-LIGHT ELECTRIC CAR FIXTURE.

The Peoples' Electric Light and Power Company, of Newark, N. J., is building a power line from the plant, in River street, Newark, under the Passaic River, to First street, Harrison, and along First street and Harrison avenue to Passaic avenue. The intention of the company is to provide motor power to factories in Harrison, Kearney and East Newark.

The contract to construct the Hagerstown, Pa., municipal lighting plant has been awarded the George A. Williams Company, of Jersey City. The bid was $52,590.20 for the complete plant, site excepted. The Williams Company bid on Westinghouse machinery. The plant will have capacity sufficient to supply 5,600 16-candle-power incandescent lamps, or about 3,500 after deducting the arc services.

Since the movement developed fully to secure for the city of Richmond, Ind., a municipal electric light plant, it has developed that such a plant can not be put under control of a non-partisan board, for the reason that there is no law to permit it. As the non-partisan board feature is one greatly desired in order to divorce the plant entirely from politics, an effort will be made to get the coming legislature to pass a law that will permit city councils to put any public work under the control of boards of trustees composed of citizens.

The Portland, Me., Electric Light Company is making rapid progress on its dam at Great Falls. A crew of 60 men is engaged in blasting a solid ledge to a depth of 23 feet, labor somewhat tedious, and in putting in a forebay wall. The Portland company has a contract to furnish four nine-foot thimbles for the dam, the first to be delivered next week. Architect Fasset has drawn plans for the power house, which is to be begun the first of August and completed by the first of October. It will be let to a contractor. By the latter part of September the company expects to utilize 1,500 horse-power.

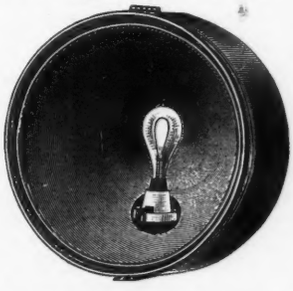


FIG. 2.—HEADLIGHT FOR ELECTRIC CAR.

At the annual meeting of the Stillwater, Minn., Gas and Electric Light Company, the superintendent was authorized to make preparation for enlarging the plant so as to largely increase the lighting facilities on the streets. The company will get power from the falls of Apple River, at Somerset, or about two miles above the plant that will provide electric power for St. Paul. The company elected as directors: E. L. Hospes, A. T. Jenks, David Bronson, David Tozer, N. N. Johnson, W. G. Bronson and R. S. Davis. The officers elected by the board are: E. L. Hospes, president; A. T. Jenks, vice-president; R. S. Davis, secretary and treasurer; N. N. Johnson, superintendent.

The great power plant at Schoharie Falls, N. Y., will soon be finished, as the Empire State Power Company, in which local capital is interested, is pushing the work rapidly. It is expected that the plant there will be in readiness to begin operation by August 1. The stone dam, which is about 400 feet long and 12 feet high, with a width of 16 feet in the centre, has been finished and is now being filled. The canal running from the gate house at the dam to the forebay near the power house has also been finished. This is about 3,600 feet long, and is 12 feet deep and 40 feet wide at the top. The construction of the power house is nearly completed, and the four water wheels, of 1,600 horse-power each, are in place. Two electric generators, of 1,200 horse-power each, have arrived, and another generator of 1,600 horse-power capacity is to be put in place. The transmission line to Howe's Cave, 16 miles south, in Schoharie County, is being finished, the poles having been erected. Preparations are now being made to begin work on the Burtonsville plant, which will have a maximum capacity of 7,500 horse-power. The maximum capacity of the Schoharie Falls plant will be 4,000 horse-power.

FIG. 3.—HEADLIGHT ON DASHBOARD OF ELECTRIC CAR.

Electric Car Lighting.

Electric light fixtures for electric street cars have to be designed with particular reference to the use they will meet and the somewhat rough treatment they are liable to receive, together with the jarring and motion of the car. The accompanying illustrations show some simple styles of fixtures made by the Wheeler Reflector Company, of Boston, Mass. Fig. 1 is a three-light fixture for the monitor of the car, constructed of mirror-plate reflecting glass and intended to reflect downward into the car that part of the useful light that otherwise would be lost in shining upward. Figs. 2 and 3 represent an electric headlight of the simplest possible type, consisting of an incandescent lamp at the focus of a parabolic reflector, the whole being enclosed in a malleable iron case and having a glass swing-door in brass in front. The design of this headlight is such that it is fastened in place by means of small bolts and requires no cutting of the dashboard other than the drilling of holes for these. As the headlight projects only four and one-half inches, it is protected by the buffer, as is shown in Fig. 3.

INDUSTRIAL NOTES

The Elgin Automobile Company, Elgin, Ohio, has placed an order with the Eddy Electric Manufacturing Company, Windsor, Ct., for 50 electromobile motors.

The Western Electric Company, New York and Chicago, states that it is now carrying complete stocks of conduits of the Sprague, Greenfield and Loricated types, at Chicago.

The Ironclad Resistance Company, Westfield, N. J., now maintains a European office and warehouse, at 57 New Compton street, London, W. C., of which Mr. Douglas C. Bate is manager.

R. L. McOuat, 125 South Meridian street, Indianapolis, Ind., reports that Peerless fans have been very popular with his trade in the middle West, and that the sales have largely exceeded anticipation.

The Electric Appliance Company, Chicago, reports that regardless of the fact that this is the most successful fan season they have ever had that they are able to ship Dayton fans promptly upon receipt of order.

The Indianapolis Arm, Bracket and Pin Company, Indianapolis, Ind., manufacturer of a line of wooden products for electrical purposes, as indicated by its name, reports that demands for its material is more active.

The International Correspondence Schools, Scranton, Pa., has issued a handsome booklet containing fac similes of a large number of letters from prominent men indorsing the course of instruction afforded by the schools.

A pretty souvenir of the fourth annual convention of the telephone people, held in Cleveland, June 14, has just been distributed by the Independent Telephone Association of the United States. The souvenir is an artistic menu of the banquet and toasts.

The Western Electric Company, New York and Chicago, is now making a specialty of feeder cables for street railways and power plants, and of weatherproof wire and cable, as well as crossarms, pins and other line material of all sorts of electrical construction work.

The Bridgeport Brass Company, 19 Murray street, New York, states that it will be pleased to send to inquirers a copy of its new "Phono-Electric" booklet. This booklet sets forth a few of the many advantages possessed by "Phono-Electric" wire for trolley, telephone and telegraph use.

The Crown Woven Wire Brush Company, Salem, Mass., has been selling a larger quantity of its well-known Crown K dynamo brushes this season than ever before, and it reports a larger increase of business from users of that kind of dynamo brushes. The company is kept busy filling the orders it has on hand at present.

Shelby Electric Company, Shelby, Ohio, is unique inasmuch as it now has a woman salesman, Mrs. M. West, traveling on the road. She is said to be most familiar with electrical matters, and particularly incandescent lamps, and before taking up her work of selling had a thorough course of training in the company's shops, at Shelby.

The United States Carbon Company, Cleveland, Ohio, has devoted two years of careful work to the development of an enclosed arc carbon with the idea of producing, in America, a carbon equal or superior to the imported carbon. It announces that it has now produced such a carbon and is desirous of sending free samples for tests to electricians and electric light stations.

The United States Carbon Company, Cleveland, Ohio, has adopted the simple and excellent method of sending out reply postal cards containing quotations of its prices for carbons of all kinds, and on the reply end a request for samples of the carbons. Electric light station men receiving these need only fill in the blanks to receive specimens of any kind of carbons they desire.

The Potomac Terra-Cotta Company, Washington, D. C., manufacturer of the Mason underground conduit, in a recent communication in relation to this line of manufacture for electrical purposes, makes the following remark, "Increased activity is manifest along this line of construction." The company has recently made some large shipments to Cuba and has filled several large contracts for telephone work in this country and Mexico.

The Michigan Electric Company, Detroit, Mich., has in stock for prompt shipment various types of the Western Electric fan motors for ceiling and desk uses. This company is also agent for the entire line of electrical specialties made by the Western Electric Company, which would come under the supply department, and also the Petite arc lamps made by that company. The Michigan Electric Company is also state agent for the Bryant sockets, receptacles, switches, cutouts and specialties.

The Sprague Electric Company, New York, has recently taken some large orders for direct-connected, slow-speed motors and generators from well-known firms who are building new factories in their respective cities. Among them are the Weston Electrical Instrument Company, Newark, N. J.; the Ithaca Wall Paper Mills, Ithaca, N. Y., and Chas. M. Higgins & Company, Brooklyn. The motors for the last-named firm are of the new enclosed type. These plants are to be entirely equipped with the Sprague apparatus.

"Edison Incandescent Lamps," is the title of a volume which has just appeared from the press of the General Electric Company. It is, perhaps, the most beautiful book illustrating incandescent lamps and their uses in lighting and decoration that has ever appeared. Its illustration is sumptuous and in arrangement and completeness of information, it is one of the best lamp catalogues that has yet been issued. It covers all of the varieties of standard, special and miniature lamps made by the company and is sent upon application to one of its offices.

William Roche, the inventor and manufacturer of the "New Standard" dry batteries, 42 Vesey street, New York, has recently acquired the building and property at this address, and, as Mr. Roche expresses the idea, "the 'New Standard' dry battery will, in future, have a home of its own." The building is five stories high and is well adapted for this manufacturing and is in a most accessible location. This firm is just placing on the market a dry cell outfit of eight cells for gas and gasoline engine ignition, also a nine-cell outfit for carriage lights and work of a similar character.

The Western Electric Company, Chicago and New York, has just brought out its bulletin No. 7005 referring to arc lamps and their accessories. The bulletin is well illustrated and contains full information regarding the numerous classes of arc lamps manufactured by the company. It is found that in the designation of lamps by descriptive names there is a large opportunity for mistakes, so the company has sought to overcome this difficulty by an arrangement of the lamps into types and numbers. By this arrangement it is thought that much confusion will be avoided and that it will be easier to transact sales of arc lamps.

The Cahall Water Tube Steam Boiler is excellently illustrated and described in a book well bound and printed on heavy calendered paper. The volume opens with an interesting essay on "The Evolution of Steam Generators," and goes on to carefully analyze the comparative values of the several methods for steam generation, and to show clearly, by most excellent engravings, the operations of the various processes in the Cahall water tube boiler. We are not informed as to the method of circulating this volume, but the Cahall sales department, Pittsburgh, Pa., the sole sales agents for this boiler, are the compilers and the book is quite interesting and instructive.

The New York Trade School, situated at First avenue, Sixty-seventh and Sixty-eighth streets, New York city, has just issued a catalogue of its twentieth season. It is hard to say too much of the excellent work that has been done and is now being done by this admirable institution. The system of instruction is such that the young men who enjoy its benefits are turned out competent to make a living. The school is not a charitable institution, a charge being made for its tuition, but the terms are merely nominal, meeting only a small part of the expense of maintaining the school. The course of instruction includes such subjects as electrical wiring, brick-laying, plastering, plumbing, carpentry, house and sign painting, printing, etc. The school is open on week days and Sunday afternoons to the inspection of the public.